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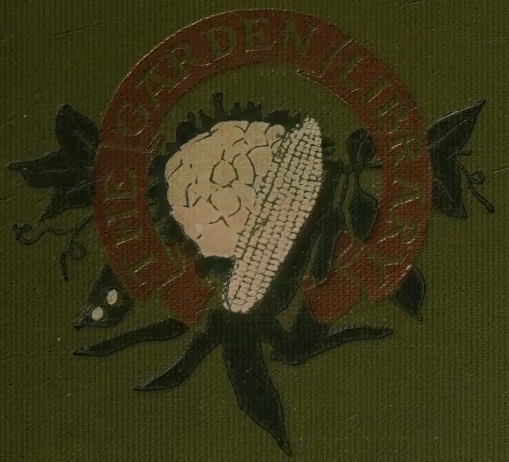

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# THE BOOK OF USEFUL PLANTS

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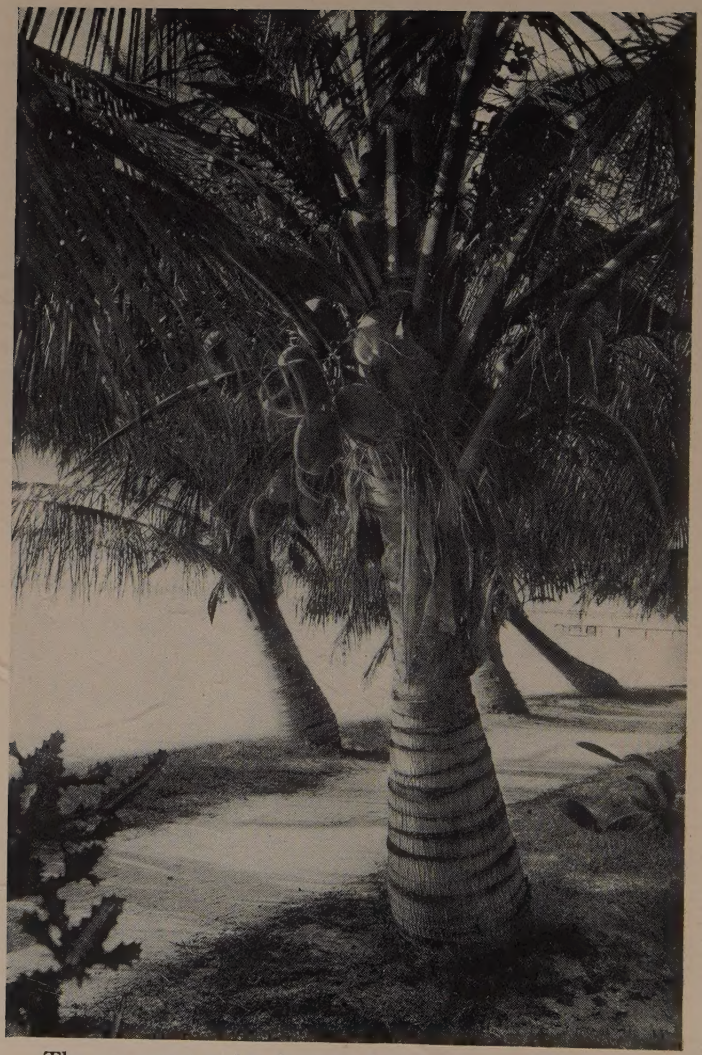

The cocoanut palm is one of the most valuable of tropical fruit trees

# THE BOOK OF USEFUL PLANTS

BY

JULIA ELLEN ROGERS

*Illustrated by thirty-one pages of half-tones from photographs*

GARDEN CITY NEW YORK
DOUBLEDAY, PAGE & COMPANY
1913

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To

THE LIVELY TRIO,

MALCOLM, DAN, AND MARY ELIZABETH,

THIS BOOK IS AFFECTIONATELY

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50,650

# PREFACE

The world of plants is a wonder world to children. The growing of a plant, from seed to seed, is a wonderful experience. The wheat that makes our bread can trace its family line back to the time when men lived in caves and were wild as the beasts with whom they contended without weapons. Grains and other plants that have ministered for centuries to the comfort and happiness of the race have long, interesting histories. A wonderful future lies before each one. We need but an introduction. Their stories grip our interest.

Boys and girls are learning to know and to grow plants. The New Agriculture has a place for each one of them. To be ready, they must learn all they can about plants. To help them to wider knowledge is the author's reason for writing this book.

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# Bread Plants

# THE BOOK OF USEFUL PLANTS

## CHAPTER I

### Rice

A yellow field that waves like wheat, but at nearer view looks more like oats, comes to harvest, sometimes twice a year, in the warm countries of the globe, especially in the regions near the sea. This is the rice crop, that feeds nearly half of the human race. Rice does well even with poor tillage, on poor soil; and better when given the careful culture that a good farmer puts upon a "money crop," one he grows to sell.

The rice plant is a grass, with long, narrow leaves, and wiry stems from two to five feet high. In India and Australia wild rice is found growing to-day on the edges of marshy sloughs and along rivers. From these wild grasses the natives gathered the seeds with care thousands of years ago, and, gradually, to the wild supply was added the harvest of patches sown with the gathered

seed and improved by cultivation. Other regions got the seed, and so the crop spread eastward through what is now the great Chinese Empire, Japan, Siam, and the islands between India and Australia.

The culture of rice in the valley of the Euphrates was described by historians who wrote centuries before the Christian Era. Rice is mentioned in the Talmud. The Moors established it in Spain. It was grown on both sides of the Mediterranean Sea; with especial success in Italy. The boy Columbus might have seen thousands of acres of rice growing in the marshy lands about Genoa and Pisa, as he wandered about, dreaming of that far-off India he hoped to reach by a new route. His expeditions opened the way for the rice industry in Mexico and Central America. In 1647 the English attempted to grow rice in the swamps owned by the Virginia Colony, but that was out of its natural habitat — too far north.

The introduction of rice into the South was an accident, though it must surely have come. In 1694 a sailing vessel, bound for England from Madagascar, encountered a gale off the coast of South Carolina and was obliged to put into the port of Charleston for repairs. Here the captain

found the Governor to be an old acquaintance. During their exchange of visits a bag of rice was brought ashore, and the Governor had it sown on a piece of swampy land he owned. The crop was a good one, and the planters of the neighbourhood went enthusiastically into rice culture. A dozen years later seventeen shiploads of rice left the port for England — the beginning of our export trade in this grain.

The Carolinas, Louisiana, and (lately) Texas, are the rice-growing states. Japan, Hawaii, and Mexico ship rice to American markets. The spread of rice culture was rapid under the slavery system in the South, but the Civil War almost ruined it. Slowly and steadily it has revived, and now is a great and growing agricultural industry.

The centuries of cultivation have developed many kinds of rice adapted to different soils, different regions, different modes of culture. Over two thousand varieties are listed. No other grain has as many. If no other record existed to prove the antiquity of the domestication of the wild species, the multitude of varieties would be proof enough. Most of them must be grown on level fields that can be flooded. But there are varieties that need the same treatment as wheat.

These are called "upland," or "hill" rice. The "wet" rice includes all the varieties that must have water about the roots, or they die of thirst.

The famous "Carolina gold" variety was developed by a planter who went into his fields at harvest time and selected for seed the best heads with the longest kernels he could find. Year after year he persevered. The variety was thus "fixed." Many great plantations of the Far East send to the Carolinas for seed, rather than grow the short-grained native sorts, for the Carolina rice greatly increases the yield. Japan has a famous rice called Kiushiu, in great demand for seed in other countries. Its kernel is short and broad, and does not break in the mill as does the long-grained rice.

The Chinese Empire has a tremendous population, but few large cities. The people are thickly distributed over the country, where they live on what can be raised on little farms — we would call them mere patches of land. The failure of crops means famine. Rice is the principal crop. No wonder the wise Emperor, Chinnong, in the year 2800 B.C., established the annual ceremonial of the sowing of the "five holy plants," that the people should keep in mind that these stood always between them and famine.

A field attached to the Temple of Earth and Heaven, at Peking, is worked into perfect condition in anticipation of the ceremony. The "Son of Heaven," as the Emperor is called, plows four furrows, with a wonderfully ornamented plow, kept in the temple for this purpose. Then the princes, the high dignitaries, and the court attendants, down the scale of rank, take turns at the plow. Forty laborers, deserving of the honor, are allowed to finish the task of preparation. Then the Emperor sows the rice, himself; princes sow millet, wheat, barley and beans. These grains are tended with especial care as they grow, and harvested by officials of high rank. The crops of each grain are stored in the temple, and used on special occasions in making offerings to the spirits of the dead ancestors of the ruling Emperor.

Viceroys in the outlying provinces of the Empire enact the same ceremony, so the people are all reached by its influence.

China's population of 400,000,000 is more than five times that of the United States. In spite of all efforts, the people cannot raise all the rice they need. The exportation of this grain has for centuries been forbidden. Little Japan, with 50,000,000 population, exports quantities yearly.

The United States uses twice as much rice each year as it produces.

### RICE FARMING

Rice culture in the United States is usually carried on in the most up-to-date manner, with improved, labor-saving machinery. The fields must be level, the soil a clay loam, with stiff clay under it to hold the water, and later to support the heavy harvester. Reclaimed swamps and the flats subject to floods along river courses were the first rice lands of the South. The fields must be surrounded by levees, or dykes, to regulate the water supply. After the grain is drilled in and has sprouted, the water is let in by raising the gates, and kept rising as the stems lengthen. The grass and weeds are mostly drowned out, but the water is drained off to allow the plants to get one good hoeing. After this, the water is admitted again, and it keeps rising until flowering time. The rice plant heads like oats, in a branching cluster of single flowers. The one grain in a spikelet, is enclosed in two tight glumes, one carrying the long awn, if it is a bearded variety. Examine any bag of rice, and you can find a grain still in the glumes, that we call the "hull."

The water supply is often many feet lower than the rice field. Pumps are used to bring it up, or it may be elevated by the principle of the siphon, a method that saves power generated by engines. Deep wells supply water to the irrigating ditches in some rice-growing sections of the Southwest. This allows tracts far removed from river courses to come under this form of agriculture.

Before the field turns yellow, the land is drained, and the reapers and binders cut and bind the grain, which is shocked, then stacked for later threshing. The use of machinery greatly reduces the need of hand labor, which is far more expensive in this country than in the Tropics and the Far East.

The methods of growing rice have changed little since the beginning of its cultivation in China and India. The plow is most primitive, often little more than a crooked pole, with its nose in the mud, dragged along by a stupid water buffalo.

The preparation of the field is often only the stirring up of the mud at the bottom of a shallow swamp, obstructed by tree roots and rubbish. The seed bed is a level patch, better prepared. The seed is sown broadcast, often sprouted beforehand. When the shoots are three inches high the

bed is flooded daily to saturate the ground, then the water is allowed to drain off. When the plants reach six inches in height they are transplanted into the mud of the field, thirty times the size of the seed bed. The work is done very rapidly, oftenest by women, the plants being set at a distance of six inches apart in rows about eight inches apart.

The plants are kept under water until they are about fifteen inches high. Then they are drained and weeded, or hoed. The water is then let in again, and remains until the harvest is almost due. The heads droop with the weight of the kernels, and if they ripen before being gathered, much grain is lost.

The harvester goes to his work with a reaping hook in his hand, lays the handfuls on the stubble to dry. Later the grain is threshed by the slow and wasteful method of treading it out by driving oxen over the straw, spread on a smooth piece of ground, or on a barn floor. Men tread it out often. Much is lost and damaged by this clumsy method.

Sometimes handfuls of straw are whipped over a sharp stone, or drawn through narrow slits, to comb off the kernels. This is slow, but it saves the rice in good condition. In its snug yellow

husks the grain is called "paddy." It is ready for the milling process, or to be stored for months, or shipped to near or distant markets.

There are various simple methods of pounding the paddy to get the hull off of the white grain. Stone mortars and pestles are used in different countries, and a vast amount of muscular energy expended in pounding large or small quantities, until all the hulls are off. The Chinese family has a daily job of pounding just enough paddy for the day's use. Children often do this work, using mallets of wood.

Then comes the winnowing process. The grain is lifted high and poured out of shovel-like baskets. The heavy grain drops to the ground. The light chaff drifts away a little distance as it falls.

It is easy to find rice imported from Japan in any large city market. It comes in bags woven of rice straw, that resembles tea matting.

Rice is deficient in oils and proteid matter, but rich in starch. It needs eggs or meat to make a balanced diet for us. That is because we are not vegetarians, as the average oriental is. He thrives on rice, with beans to supply the elements we get from meat. But he eats the whole rice, and so gets the richest part of the grain, which

American rice mills sacrifice in order to get a white, polished grain.

In the American mills, rice is first received as paddy from the threshing. It is cleaned of weed seed, then hulled, then winnowed, then ground to remove the bran, and rubbed between sheepskin buffers to polish the grain. Now the sifting process takes out the broken grains and the starchy dust, and the grain is graded for market.

Our rice is white, but tasteless when cooked. "Brown rice" is rich in flavor, and has a creamy color. Those who taste rice in Japan, or cooked in the Japanese way here, do not wonder that the little brown men were able to defeat men and armies much larger than their own, and to keep well and strong on a diet of rice.

Some American grocers carry a limited quantity of "brown rice," the paddy with hulls removed.

Fermented rice is the basis of the national beverage, called saké, which the Japanese drink hot out of tiny porcelain cups at the beginning of a meal. At weddings a good deal of saké is drunk, and as it contains a high percentage of alcohol, the people may become intoxicated. The Chinese and the natives of different East

Indian islands have their own beverages made of fermented rice.

Europe imports great quantities of rice for food, and for the manufacture of starch. Calicoes are stiffened with a paste of rice powder. Broken rice, the dust from rice mills, and the straw and hulls all make good food for cattle. The straw is used in making bags, hats, shoes, and other wearing apparel. Plowed under, the stubble enriches the soil.

Not only is rice the greatest grain crop of the world; it is one of the most beautiful of cereals as it grows on hillsides in Japan. The brooks that flow down the mountainsides are tapped by side channels that lead the water onto wonderful flat terraces, all planted to rice. Step by step the water trickles down, each little patch watered, and giving the water again to the level next below it. Constantly the supply is renewed from above. The trees form lovely frames for the pictures as the grain turns from green to gold, and the widening brook finally pours its waters into the marsh that is a broad, level sea of rice, ready for the sickle. In September the golden ricelands are as beautiful as the orchards and gardens that burst into bloom in cherry blossom time, the month of May.

## WHEAT

Let us look first at a single grain of wheat, out of the bagful the farmer is about to sow, or the miller is about to pour into the hopper, to grind into flour. It is an oval body with a deep crease running lengthwise on one side, a tuft of fine hairs at the tip, and the *chit*, or *embryo*, at the base, and directly opposite to the groove. From this chit the wheat plant rises. Stored under the protecting coats of the grain are the food elements that are to nourish the little plant until its own leaves and roots are able to support it independently. The baby plant and its lunch basket are wrapped up in the grain we are looking at.

Without a microscope it will be difficult for us to make out the various coats that wrap the store of starch that forms 93 per cent. of the kernel's bulk. Six per cent. of it is the embryo, with its shield that protects and absorbs food for the minute plantlet, whose root and stem are visible when the grain is soaked. The seed wrappings form the remaining 1 per cent. of the whole.

A thin skin, the epidermis, covers the grain. Four coats under the skin compose the bran, the third from the outside being the coloring matter which gives the brown tinge to whole wheat flour.

Under the bran layers is a layer of gluten, that envelops the central body of starch and the chit, and weighs 8 per cent. of the grain. This is the part that is sticky; because of its presence in wheat flour we are able to have spongy bread, "risen" with yeast.

"Light" bread that is also white bread, is so commonly used by nations of the highest civilization that an American must travel widely in order to realize that in many countries it is a luxury enjoyed by few. Other grains form the staff of life, and bread is not white. One of the distinctions of the United States is the fact that it raises more wheat than any other country, and the poorest families eat white bread as regularly as their rich neighbors.

## WHEAT FARMING

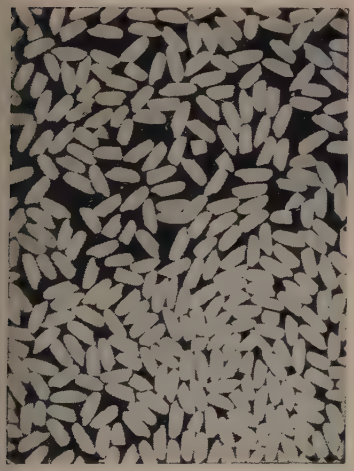
The farmer sows his wheat broadcast, by hand, if he is old-fashioned and skilful, and has a small field; otherwise with some kind of drill, or seeder, that plants a large area more evenly and more quickly that can be done by hand. The ground must be a deep, well-drained, rich, clay loam, mellow and free from weeds, if a good crop is to follow. Next to the sowing comes the har-

rowing, unless the seeding is done by a press drill, that puts the grains underground at least an inch. The harrow kills weeds, breaks up the surface crust and covers the seed. The newest tool, the press drill, does all these operations at once: seeding, covering, and smoothing the bare ground over the seed.

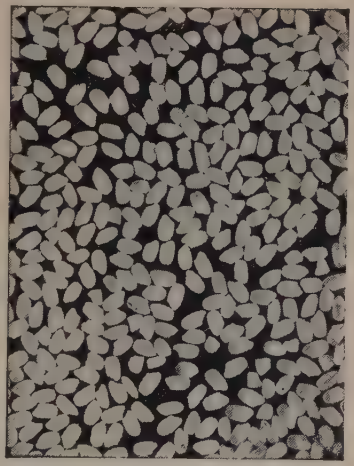
If weather is fair and warm, the wheat field shows its green spears at the end of the second week after sowing. Soon the bare ground has turned green as a lawn. One long leaf at each joint of the stem is the rule with the wheat plant, and that leaf in two sections: the lower half clasps the stalk; the upper half extends outward, exposing its flat surface to the sun. This is the part that waves in the breezes. Many people would overlook the tubular part that strengthens the stalk, and only serves its leaf function by exposing the green under surface to the sun. When wind lashes the standing grain the leaves swing around without breaking, because the basal half of each is tough-fibred and takes a spiral twist around the stem. This saves the leaves in many a storm from being whipped off.

The swollen joints, too, save the wheat that gets "lodged" by wind. Strangely enough, the swelling of the base of the leaf-sheath on the side

A good variety of beardless wheat



Honduras and Carolina varieties of rice have long kernels



Kiushiu rice has short kernels that do not break badly in milling

Rarely does a field of oats stand as high as the farmer

Fine barley grows in these irrigated mountain valleys

that has bent over lifts the stem toward the erect position. All the leaf bases help, and the plant soon stands vertical again. These bases remain soft even when the leaf is getting yellow. The effort to lift fallen grain is not so successful, after the stalks are ripe.

One of the peculiar habits of the wheat plant is "tillering." The stem that first comes up from each grain of seed that sprouts is quickly joined by shoots that rise from joints underground.

Three main roots strike downward from the chit as the *plumule*, or stem, shoots upward toward the light. But the "crown" of the wheat plant is higher than the seed, which is not lifted up in sprouting, as beans are. A group of much stronger roots strike down from the first joints of the parent stem, and the "tillers," or secondary stems, rise around their parent, forming a "stool." The thinner the sowing, the better chance for these side shoots to multiply; and the deeper the grain is planted, the more joints of the original stem will be covered with soil and able to "stool," sending roots down and stems up.

The best wheat plant is the one with the greatest number of strong stalks. In the average field the number of stalks from a single seed is from six to twelve. Exceptional plants have three to four

dozen stalks. The plants from feeble seed may have but two or three feeble stalks. So the farmer who sows poor seed is wasting time and labor.

When the wheat stalks are full-grown they blossom in long spikes or heads, made up of "spikelets" (side branches), each with a few flowers, and enclosed in papery coverings, called *outer glumes*. These glumes are set alternately upon the stem. Each pair of glumes opens at flowering time, exposing one to four pairs of smaller, more delicate glumes each one a wheat blossom in the bud. The smaller glume is the *palet;* it lies next to the stem. The larger one may have a long, rough spine that protrudes an inch or more. Such wheat is a "bearded" variety. Between the palet and this outer *flowering glume* is the ovary, containing the plump ovule, with two plume-like branches of the stigma held above it. On the sides stand the three stamens, that hang out their large anthers on slender filaments when the glumes part for the wind to do its work of carrying pollen from opening anthers to waiting stigmas. To some extent, wheat flowers are pollenated within the bud. But the wind does the cross-pollenating, which makes more vigorous, larger grains than self-pollenation.

A "head" of wheat, three or four inches long, may have fifteen to twenty spikelets filled out, and a few that failed and dried away. Each spikelet had from one to four flowers; so two or three grains of wheat may be the average in each spikelet. Counting them all, the head may yield thirty to fifty grains of wheat. Now count the heads borne by the single plant, and how many grains are the harvest of a single seed sowed? Three or four hundred grains are possible, but not usual.

Five pecks to an acre is the average amount of wheat sown in the United States. "In ten years, one grain of North Dakota wheat produced 300,000 bushels." The average yield per acre in the United States is about thirteen bushels. In the Northwest, sixty and seventy bushels an acre are not uncommon. A thousand-acre field that yielded 51,000 bushels holds the record for a field of that size. Germany and England average more than twice the yield of American wheat fields. Older fields, but better tillage and more fertilizers put upon the land, make the difference. Better farming is increasing the yield of crops, but wheat farming has been one of the worst robbers of the virgin soil of our country.

## THE WHEAT HARVEST

When wheat begins to turn yellow, the time of harvest is near. The farmer dents a kernel with his thumb nail. If it does not burst, it is ready for the sickle. The best flour is made from wheat that is dead ripe when harvested. But it is not possible to get a large field cut at just the best time. So it is usual to begin the reaping before the grain is quite ripe, trusting to the after care to offset the disadvantages of cutting it under-ripe. If over-ripe the standing grain is attacked by birds, the wind breaks the brittle stalks, and shells out the loose grain. Rainy weather fades the color of the kernels and sets them to sprouting. A few days' delay at harvest time may lose the farmer half the value of his entire wheat crop. In regions of little or no summer rain, the harvest hurry is not so great.

The first harvesting tool was the hand sickle, some form of knife that gathered and cut off a bundle of straws as they grew. Before the sickle was invented, the wheat was pulled up in handfuls as flax is pulled to-day. After the sickle came scythes, and then the "cradle," swung by both hands, and followed by a man who bound the grain. Expert cradlers cut three and four acres

of wheat a day. Then came a procession of improved machinery aimed to replace human muscle with some other power, used by a machine that does its work quicker and better than the man with the cradle.

Headers pushed through the grain, stripping the heads by means of a coarse comb set on the edge of a cart, were used in Gaul at the beginning of the Christian Era. The power was furnished by an ox hitched between shafts at the back of the cart. The driver raked the heads off of the knives into the cart. This machine was in use for centuries. Then it was abandoned and forgotten for centuries more.

The publishing of an account of this machine, described by Pliny in 70 A. D., led to the invention of the reaper with revolving reel; and finally came the combined reaper and harvester, based on the principles first employed in the crude Gallic header. Gradually the inventive genius of this country has improved the machinery devised in England until now the wheat on the great farms is cut, threshed, and flung on the ground in tiers of sacks, ready for shipment, the grain not having been handled by men during the whole process.

One of these great "portable factories," used

in California wheat fields, cuts a forty foot swath, is drawn by a traction engine, and its day's work is to cut, thresh, and sack the wheat from 120 acres. It takes eight men to operate this combination harvester, at a cost of but thirty to fifty cents per acre. Since the price is about $7,500, these big harvesting outfits belong to wheat-raising on a mammoth scale.

The self-binder, drawn by several horses driven by one man, is seen harvesting small wheat fields. It is followed by helpers who shock the grain, to dry it before it is stacked. Threshing comes later, and the grain may wait for months before it leaves the granary for the mills.

The harvest of wheat in our own country has been described above. America is by no means the only wheat-growing country, though it is ahead of all others in the world. Russia is its greatest rival. The smaller countries of Europe all grow wheat, many of them more than they need for home markets. India, Siberia, North and South Africa, Australia, New Zealand, Argentina, Chile, and Uruguay are all wheat-growing countries. Most of the wheat is raised in the northern hemisphere, and much is shipped thither from the southern wheat regions. Canada is becoming one of the greatest wheat countries of the world.

## THE KINDS OF WHEAT

Between two and three hundred varieties of wheat were selected from a thousand varieties tested by the United States Department of Agriculture, as best adapted to conditions in different parts of this country. The vast number of varieties grown the world over prove that wheat is one of the oldest plants in cultivation. History tells the same thing. In the accounts of the childhood of many nations, the growing of wheat is fully dwelt upon, and the making of white bread from the ground grain.

The Lake-dwellers, of the early Stone Age, left behind them in their strange, prehistoric habitations, grains of wheat half the size of modern varieties. Researches have found four different species represented by the stores uncovered in Switzerland.

Wheat was the staple crop of the ancients in Egypt and Palestine. The Chinese raised it for more than three thousand years. No wonder that the botanists have given up hope of finding the wild species from which the cultivated forms have sprung. In all probability, it is no longer growing wild anywhere. However, it is believed that the original home of the wild wheat was in the valley

of the Tigris and Euphrates rivers, and from thence it spread in all directions, and has become the principal food plant of civilized nations.

Four distinct species of wheat are recognized as parents of the cultivated varieties: 1. Common wheat (*Triticum vulgare*) bearded and beardless, white and red, winter and spring — an ancient type. 2. Poulard wheat (*T. turgidum*) called Egyptian wheat, and "wheat of miracle," because its spikes break into fruitful branches. Not an old type. 3. Hard wheat (*T. durum*) probably derived from common wheat. 4. Polish wheat (*T. polonicum*) the German *gummer*, a large plant, with small heads, much grown in Spain.

Related to wheat proper are the spelts, one-grained species, with a husk around each kernel, and the two-grained, or starch wheat, called *emmer*. These are comparatively primitive and unimportant grains.

How does a variety originate? This is one way. Mr. Abraham Fultz was walking though his wheat field one day, and he happened to see a plant that bore three heads of beardless wheat, in a field that was bearded. He gathered the heads, which were large, and the kernels good. He planted them the next year, and the plants produced were so fruitful that he decided to save all

the grain, and grow it for a number of years. In a surprisingly short time he has "fixed" the characteristics of a fine new variety. He distributed seed and now the "Fultz wheat" is the leading soft winter wheat in this country, and is established in many foreign countries. It originated in 1862.

Another way of originating a variety is to choose only the best seed for planting, and only the best again out of each planting of the selected seeds. Gradually the plants improve in size and quality and an improved variety is achieved, whose yield is several bushels per acre better than before the selection of seed was started.

A third way to get a new and better variety is to cross artificially two varieties whose characters it is desirable to join. A sturdy straw, bearing full, large heads may result from crossing a variety with one of these traits and another with the other trait. So two varieties, each with bad faults may be combined to make a very good one.

Cross-fertilization is a delicate, but simple operation, that must be begun while the flowers are in bud, the stamens removed to prevent self-fertilization in the flowers that set seed for the new strain. Pollen is carried by a camel's-hair brush to the ripe stigmas, which are protected before and after this pollenation by tissue paper,

securely wrapped and tied above and below the head.

Is such work as making new varieties worth while? Mr. Burbank says: "If a new wheat were bred that would yield only one grain more to each head, Nature would produce annually, without effort or cost for man, 15,000,000 extra bushels of wheat in the United States alone."

### THE WHEAT DISTRICTS

The *soft wheat* district is along our North Atlantic coast. The *semi-hard* district is south of the Great Lakes. *Hard spring wheat* culture centres in the Red River Valley. Kansas is the centre of the *hard winter wheat* district. The *durum wheat* area centres in northern Texas. *White wheat* grows on the Pacific coast. *Red wheat* grows from Kansas to the Red River Valley. White wheats are starchy. Wheats rich in gluten make the best bread. Such are the varieties grown on the northern and central plains of the United States, Canada, southern Argentina, and eastern and southern Russia. *Macaroni wheat*, rich in gluten, grows in the Mediterranean countries. *Durum wheat* grows well on alkali soils, and in semi-arid regions. It is a sturdy new

group of drought-resistant, rust-resistant varieties, that has made wheat-growing possible in regions where, a few years ago, no known varieties would have any chance at all. Our millers are learning to mix it with other kinds in flour. It is a fine macaroni wheat.

Strength of the straw of some wheats make it a valuable by-product of the harvest. Leghorn hats are woven of the wiry stems of an Italian wheat, a Tuscan, bearded variety. Roofs are thatched, chairs seated, mattresses stuffed, bee-hives and baskets woven of wheat straw. It is a good fodder for cattle, green or dry. Twisted into hard ropes it often furnishes fuel for the engines that run the great harvesters. Pressed into bales, and these built into temporary walls, the straw often holds thousands of bushels of wheat in storage until time for shipment comes. Used as bedding in stables, straw finally returns to the soil with the stable manure, adding vegetable fibre that loosens heavy clay, and makes of it good loam for the growing of wheat.

## OATS

Wheat, rye, and barley are members of one subdivision of the great Grass Family. They all

bear their seeds in spikes, bald or bearded. Oats stand alone, the grain with a loose, branched head, made of separate kernels. Each kernel has an outside papery husk and an inner hull that is ground up in making oatmeal, or removed in some forms of the cereal. Oatmeal feeds thousands of people every morning of the year.

Botanists, curious to find growing the wild parent of cultivated oats, are constantly being deceived by patches of oats, wild enough, but only runaways from fields. The seeds are often carried by birds, often by other chance rides. Oats are able to get on very well in wild land, where they come up year after year, and spread over wider areas by self-seeding. It is not likely that any one will ever find the aboriginal species of oats, and feel sure enough to satisfy himself.

Yet it seems probable that this grain was first cultivated in the temperate and colder parts of eastern Europe and western Asia. Its culture has extended into the United States and Canada, and eastward into China and Siberia, until to-day the oat crop is greater in bulk than any other grain crop.

Oats, "the grain of hardiness," divide honors with wheat, barley, and rye, in fields that stretch up north almost to the Arctic Circle.

In the bleak climate of northern Scotland, this is the staple food crop. So it is in Iceland, in Alaska, in Russia, and Siberia. Rye and oats furnished the bread of Europe in the Middle Ages, and wheat bread has replaced the coarser loaves and cakes but partially.

The reason oats are so extensively used as human food is because they lead all the grains in muscle-forming elements. They contain a large proportion of oily and nitrogenous materials, and a low percentage of starch. Oatmeal porridge is given the credit for producing the brain and brawn of the Scotch and other hardy European races.

England raises oats, but oatmeal porridge is not a national dish. The famous dialogue contains both a clever retort and a plain fact. An Englishman, with a party of friends, met on the road a Highlander carrying a bag of oats. Pointing to it he said: "That is oats — the grain that in England is fed to horses; in Scotland it is fed to men!" The Scotchman was not so stolid as he looked, for his reply came promptly: "True enough; and that is the reason why in England you grow such fine horses, and in Scotland we grow such fine men!"

Oats grow best in cold regions; they do poorly in countries around the Mediterranean, because

the climate is too warm. The same is true in parts of the United States. In some regions where the heads do not fill out well the grain is profitably sown for forage and pasture. The succulent stems are rich in nutriment, they dry quickly and make excellent hay. Plowed under, they enrich the soil.

Oat straw is used extensively for paper-making, for packing, stuffing mattresses, and for bedding for stock in barns.

*Smut* is a fungous disease that appears when the oat plants should be setting seed. Instead, the heads become masses of loose, black powder. The particles of dust are the spores of the destroying smut. They are scattered by the wind, and lodge in the spreading bracts, the green "chaff" of sound oats. When these oats are sown next spring the spores sprout with the sprouting of the grain. The fungus grows into thread-like meshes that penetrate the tissues of the young oat plant, robbing it of the food that the leaves prepare, and finally replacing the seeds entirely with the black, slimy masses that ripen into the black powder.

Only oats that carry the spores into the ground with them will produce smut bodies in the place of kernels. This fact enables the farmer to prevent the disease. He simply soaks his seed oats for a

day in a weak solution of formalin, a cheap drug that destroys the smut spores hid in the hulls, and does not injure the kernel at all. Spores that fly about the oat field cannot injure the plants they lodge on, but next year's plants are endangered. The formalin bath saves the farmers of the United States millions of dollars annually in the oat crop.

## RYE

Because it grows on soil too poor and arid for other grains, rye is called "the grain of poverty." Rye meal makes the bread of peasants in European countries, over a vast area of the poorest, and so the cheapest, land. The extremes of heat and cold are suffered by these people, whose agriculture is of a hopelessly primitive sort. They scratch in the grain, drag or harrow it, and gather the harvest with hand sickles, as their parents have done for generations without number.

In Russia more rye is grown than in any other country. It is a great crop in Scandinavia and northern Germany, where everybody eats rye bread and likes it. The German "pumpernickel" is a bread that many Americans like. Not all of them know that they are eating the rye loaf, the "black bread," of Europe. The liking for this

loaf may be hereditary in those of us who come of New England ancestry, for the brown bread that accompanied the baked beans was "half rye and half Indian meal." That loaf was and is deservedly popular.

Rye is a grain used extensively in the making of whiskey. It is more for this purpose than for any other that the crop is raised in the United States. Poor land is often sowed to rye for its improvement; the green crop is turned under or pastured, the roots left to form humus.

Rye straw is wiry and long, on good land, and though too fibrous to make good forage for cattle when ripe it is the best for making paper and pasteboard, for straw hats, and bedding stables for horses. The longest straw is used by gardeners to wrap tender trees and shrubs that must stay outdoors all winter. It is used as packing material by manufacturers of all kinds of fragile wares. The straw often pays better than the grain.

Rye is known in very few varieties, and is probably not one of the oldest cultivated grains. Its parent form, botanists say, grew on the mountainous, dry regions from southern Europe eastward to Central Asia.

The "head" of a stalk of rye is like that of

This boy grew 239 bushels of corn on an acre of his father's farm in South Carolina

A field of buckwheat in bloom is a dream of loveliness in the twilight

bearded wheat; the prickly, needle-like beard makes the handling of the grain at harvest time very hard on the hands of those who bind and stack the grain. The flower of rye is similar to to the flower of wheat.

The grain contains more bran than wheat, and less starch, but more sugar. Rye bread is dark in color and sweet, with a flavor that is pleasantly aromatic and slightly sour. It spoils the flour to grind rye fine and discard its bran, for therein the characteristic taste is found.

Rye is particularly susceptible to attack by a fungus called ergot, whose black or purplish body develops at the expense of the kernel. The destruction of a part of the grain crop is not all the harm this disease does to the farmer. Cattle fed on hay and grain infected with the fungus are gradually poisoned; they develop loathsome sores, and may lose hoofs, tail, ears, and horns as the disease progresses.

To prevent the spread of ergot in grain fields and pastures, infected plants must be cut and destroyed. Farmers who understand that the spores are carried by wind to fields in bloom are careful to have roadside grasses cut. They also dip their seed grain in a fungicide, like diluted formalin.

## BARLEY

Barley is the hardiest and one of the oldest grains in cultivation. It will grow much farther north than wheat; it is a staple crop in Norway, Russia, and Siberia, where it grows right up to the Arctic Circle. This is a grain from which the bread of peasants is made; and people who scorn to eat barley, drink it in the form of ale and beer. The coarse, unleavened barley cakes of Scotland are nutritious, but the grain is lacking in gluten, a very important food element. Barley flour will not make "risen bread" any more than cornmeal will. But it has the whole nutritious grain, minus only the hard cuticle. "Pearl barley" has lost some valuable substance by the processes that grind the kernel to a smooth, polished ball. It is chiefly used in soups and gruels.

The great demand for barley comes from the brewers, who use it in the making of beer. This is the reason it is preferred to other grains: it is quickest to sprout. The sprouting process changes the starch of the kernels into a kind of sugar, called *maltose*.

The grain is first cleaned, then soaked and spread out in a warm place to sprout. When the little root is two-thirds the length of the grain, the

transformation of starch to sugar has been completed. The grain is now heated, to kill the growing parts and dry the kernels. The process just ended is called the "malting" of the grain. The dry malt may be stored or shipped. Before being used further it is ground into meal, then mixed with water, which soaks out the sugar. The liquid is now strained, and yeast is added to it, to set up fermentation. Alcohol and carbonic acid gas are two substances into which the sugar is transformed. In the casks, the gas is confined, so that when the beverage is drawn, it is liberated in the bubbles that rise in foam at the top of the mug or glass. The hops used keep the beer from souring. By the same general process ale and porter are made. Gin and whiskey are made by distilling the alcohol from the light beverages. Beer contains but 2 per cent. alcohol.

Another fact that makes barley "the brewer's grain," *par excellence*, is this: it grows in warm as well as cold countries. Turkey and France and California raise a great acreage of this grain for the breweries. "Chevelier," the best variety for brewing, is grown to perfection in the valley land of the Coast Range.

Wild barley has been found growing in western Asia, but whether it escaped from cultivation, or

represents a race that never came under the hand of man, it is not possible to decide. It has two rows of kernels in the head — a type that was found in the remains of the civilization of the Lake-dwellers, who represent man in the early Stone Age. With it has been found the six-rowed species, which the earliest Egyptian monuments also preserved. A strange fact is that the common four-rowed species is not represented among the barleys grown by these primitive peoples, though both of the more productive species must have originated from the scanty, two-rowed kind.

People who eat barley bread are becoming fewer as the conditions of life are eased. Immigrants from the north of Europe to Minnesota grow barley, first for themselves, but soon for their cattle, only. It is a good green forage and pasture after an early crop is taken off the land. As a catch crop, it is sowed in summer and plowed under. This "green manure" adds to heavy land the fibre that converts it into a mellow loam, easy to work, able to hold moisture, and richer by the addition of plant foods the soil needs.

## CORN

The biggest thing in this country is our corn crop. And the most wonderful thing about it is

that each year the crop is bigger,— the miracle is repeated, more granaries are filled each time the autumn rolls around. Let us look at a few figures, and try to grasp their meaning. In 1910 our corn crop was worth over $1,500,000,000! Four times as much corn as was raised in all the cornfields of all the other continents. A procession of farmers' wagons, each loaded with fifty bushels of corn, and drawn by the farmer's team, would be long enough to reach nine times around the earth. For when a girdle is complete, there would be left in cribs and elevators eight times as much corn as was in that single line of wagons, twenty-five thousand miles long.

The great corn states are Illinois, Iowa, Missouri, and Nebraska. In 1910, Illinois raised 414 million bushels, almost one third of the crop in the whole country. Large-eared dent corn is grown in the great "corn belt" of the central states. The yield per acre averages but twenty-seven bushels. Many farmers raise three times that quantity. The northeastern states, that raise the round-grained flint corn, do not have a large acreage, but the average yield is high, despite their wornout land. Down South the average crop is much lower than in the corn belt, partly due to careless, unenlightened farming.

Of the stupendous corn crops raised in the United States only 4 per cent. goes to other countries as grain and meal. We feed the rest to cattle and hogs, and ship the meat. This brings the farmer much more money, and returns to the land much of the best fertilizing elements in the manure from the yards where stock is fattened. The man who sells his corn from the crib robs his land, year after year. He must fertilize it, and buying commercial fertilizers is a costly method.

Better corn and more of it result from careful selecting of seed, and sorting and testing it before planting time. This is an important step in the great forward movement in farming to-day.

### THE RACES OF CORN

We find in New England cornfields, *sweet* corn and *flint* corn; in the Corn Belt of the Central States, chiefly the *yellow dents;* in the South, *white dent* varieties. *Dent* corns have their starchy content extended to the top of the grain, and shrinking at maturity, thus forming the dent, or depression. *Flint* corn is not so, for the starchy centre is overlaid with the layer of hard, horny material that does not shrink.

*Pop* corn is small, and its grains explode into a

light, cottony mass when heated. *Sweet* corn is rich in sugar and protein. Its kernels shrink and wrinkle in drying. *Pod* corn, called also "coyote corn," is a Mexican race that has each kernel, as well as the ear, enclosed in a papery husk. Pop corn may have originated from a primitive pod corn. In the mummy cases of Peruvian tombs grains of another type were first found by scientists. It is called *soft* corn, because the horny part is wanting in the grain. It is now grown in Mexico and parts of South America.

Darwin thought that all the "agricultural species" of corn are descendants of the pod corn of Mexico. The best authorities now hold that the aboriginal ancestor of corn is probably extinct. The corn-like plant, *teosinte*, that grows wild in Mexico, is believed to be one parent of corn, but the other is unknown. Wild corn has never been found.

Whatever the form of the original wild species, there have sprung from it the six races named above: pod, pop, sweet, flint, soft, and dent.

Sweet corn was in cultivation by the Susquehanna Indians in 1779, when its qualities were first discovered by white settlers. No history of the species is known behind that date, though

many varieties have been developed since. The great industry of canning corn is supplied by fields of this green crop. It is an important vegetable in American gardens throughout the growing season.

The seventy-day corn of the colder parts of the country, that makes a dwarf stalk, and attends strictly to the business of maturing the ears before frost comes, illustrates the changes that adapt a plant to its environment. The 20-foot stalks in a Southern field, that take six months to produce a crop, illustrate the same fact. Varieties have "strains" adapted to difficult conditions of climate and soil.

The native country of the maize plant is probably Mexico. We cannot be sure. It was unknown in Europe when the Spaniards under Columbus found the Indians on the Island of Haiti growing fields of a strange plant they called "mahiz." In a letter to Ferdinand and Isabella, Columbus says of his brother: "During a journey into the interior he found a dense population, entirely agricultural, and at one place passed through eighteen miles of cornfields." De Soto wrote home about the Indian villages, where corn and meal were stored in large quantities, and miles upon miles of growing grain

surrounded them. Cortez was amazed at the flourishing fields of corn growing in Mexico, and the stores of this grain gathered as tribute by the ruler. The Puritans were saved from starvation during those first terrible winters by corn brought them by the friendly Indians. Fifty years later the same Puritans, or their sons, in the King Philip's war, "took possession of one thousand acres of corn, which was harvested by the English, and disposed of according to their direction." The Six Nations, the best-organized confederation of American Indians, had cultivated apple orchards and cornfields that the white settlers could not match, in central New York. In the middle part of the country other tribes raised corn for their food supply. Indian mounds, of uncertain but ancient date, contain corn, as did the tombs of the Incas in Peru, where the maize plant was worshipped as a divinity that had the life of the people in its hand. Far back to the earliest times goes this reverence for the plant that feeds the race.

No wild plant that looks at all like corn has been found in foreign countries, though a thorough search has been made in all likely places by scientists. The best authorities agree that if the plant had been grown in Europe or Asia before it was taken there from America it would have been

known and written about. So it must be American in origin.

The corn kernel is a little plant, wrapped up with the provision that is to sustain it through the period between its sprouting in the ground, and the appearance of root and leaf blade, capable of supporting the plant independently. All these possibilities and good promises are wrapped up in a tough, waterproof skin, the hull of the grain. The clear, horny portion under the hull is rich in protein, the muscle-making part. The germ, or embryo corn plant, is rich in oil. The white filling of the kernel is starch, the solid, granular portion that was soft and sweet when the corn was "in the milk." It is quite possible in corn to separate the parts bearing oil, protein and starch, at a glance, for the germ has a distinct shape and outline, and the dark proteid matter contrasts in color with the white starch.

## CORN PRODUCTS

What a good all-around food the maize is! Do we use it as it deserves? Nothing tastes better when one is hungry than corn muffins, or a loaf of "Johnny-cake." The corn flavor is unexcelled when good cooking brings it out. What

else but this rich flavor makes the epicure take real delight in the "hoecakes" of the mountaineers? These are nothing but fresh meal mixed in water to form a smooth batter, which is baked on a hoe or on stones in an open fire. The Indians originated the "corn pone," baked in the ashes, still one of the most delicious foods made of corn meal. Hominy and grits are cracked corn, which are boiled into a porridge. Samp is hulled corn, of which Roger Williams wrote: "The Indian corne, beaten and boiled, and eaten hot or cold with milke or butter, is a dish exceeding wholesome for English bodies." Succotash is the Indian mixture of green corn with beans, which they called "msickquatash." Sweet corn on the cob is delicious. So are green corn puddings, and the same corn, canned or dried for winter use.

Parched corn was a staple food of the Indian tribes. (No doubt parched corn led up to pop corn.) On their long journeys the Indians carried little bags of parched corn, which they ate with water, and it sustained them in times of war, and on hunting expeditions. It was no inconvenience to carry enough for several days in the wilderness.

Glucose is made from the starch in the corn grain. Formerly the glucose mills discarded the

germ and the horny portion, both rich in food elements. Now the germs are ground and pressed to extract the oil, which is exported to European countries where it is considered one of the best lubricants. It is used also in soap-making, and for cooking. A process of vulcanizing converts it into a substitute for rubber.

Dextrine, a valuable gum, is a by-product of the starch and glucose factories. Alcohol and whiskey are made from the fermentation of the whole grain. Ground fine, the flour and meal of corn are among the best cereal foods, though the abundant oil is likely to become rancid in a short time.

Corncobs are an excellent fuel. They are burned in the engines that drive corn threshers and other farm machinery. Corncob pipes are made of quantities of them. The stalks, leaves, and husks yield fibre suitable for use in making papers and varnishes. Nothing is so good as corn-stalk pith to pack the water-tight compartments behind the armor plates of battleships. Corn silks are used in making filters. The husks have long been woven into door mats and stuffed into mattresses. Dry stalks make winter pasture for cattle and horses. Green corn is put into silos to feed dairy cattle in winter. Cut up, it makes part of a balanced ration for stock and poultry, espe-

cially when mixed with the cake from which corn oil has been pressed.

## POP CORN

The Tom Thumb race of corn has in the starchy part of the grain sufficient moisture to explode it when heated. This "popping" of corn turns the grain wrong side out, dries it and makes it twenty times as large as it was before. Because it has an excess of protein, pop corn is very nutritious. Combined with syrup, it is a confection that children enjoy, and wise parents are glad to give them. It makes a delicious, easily digested, and wholesome food. The only trouble is that factory-made pop corn balls and bricks are often stale, and not sweetened with pure sugar. Home-made things are usually best.

In various parts of Iowa and neighboring states quantities of pop corn are raised by farmers that give their time to this crop. They sell it to the wholesaler, who supplies the manufacturer. As a rule, the crop is kept till the second year. It is too moist to pop well before that time, unless kiln-dried.

Two races of pop corn are grown: the *rice* type, with clear, horny grains sharply beaked at the

place where the silk was attached, and the *pearl* type, with grains rounded on top, like the flint corn of the fields, or flat-topped. Red, blue, and white are the colors of the grains, solid or mixed on the cob. The pop corn field is easily recognized by the slim stalks and small ears, though the stalks are often tall.

It is a special kind of farming to get the crop matured before frost; then it must stand to let the frost harden the ears before the stalks are cut and shocked to dry, then husked by hand for storage or immediate shipment. One little town in Iowa is the point from which hundreds of carloads of pop corn go each autumn to the wholesale dealer.

## THE WONDERFUL MAIZE PLANT

A sprouting grain of corn sends a pointed leaf, rolled into a close tube, up to the light, while a tapering root goes downward, and branches into fibrous feeding roots along its sides. Out of the tip of the leaf tube a slenderer tube rises, and carries the plant higher, while the first leaf spreads out flat. As the leaf arches its blade, the second one loosens, and the third appears. Each leaf holds its younger brother in a close protecting embrace until it is able to endure the hot sun, when

this one becomes in turn the nurse of another. The stalk is hidden by the sheaths of the several leaves, until at last the tassel appears, and leaf-making is at an end. In the angle of certain leaves the stem sends out short branches. These are clothed with crowded leaves, and topped with a bunch of long silks. Tassels and the miniature ears are the flower clusters of the corn plant.

*The leaf of the corn plant.* — All the food the roots gather is carried to the leaves for chemical transformation into nutritious sap. Crude materials gathered from the soil and absorbed from the air, assemble in the leaf laboratories, where the energy of sunlight is used to convert raw materials into rich, starchy food, which flows back to supply the growing parts of the plant.

The arch of a corn leaf is graceful, indeed. What is far more important to the plant is the fact that the greatest possible amount of leaf surface is exposed to the direct rays of the sun. When the air is moist, "you can see corn grow" in midsummer. The starch factories are working at great pressure. Farmers say "you can hear it grow" by night. A multitude of snapping noises are heard, suggesting the lengthening of fibres. Quantities of water are exhaled as invisible vapor from pores located chiefly on the upper surface of

each leaf. When the dry winds rob the soil of moisture, the roots go deeper. The leaves roll their edges inward and sometimes overlap, in order to reduce the amount of surface exposed to sun and wind. The pores are thus closed to save the water supply. When rains come, the normal conditions are restored, and food-making becomes the chief business of the plant. Notice how the corn-husks, even, spread out into leaves, to do their share of this work while their bases protect the ear. Even the stalk is green, and able to join in the labors of the leaves.

How is it that the corn plant can carry so much sail, and yet not have its leaves whipped into strings by the winds? Test for yourselves the flexibility and strength of the midrib of a leaf, the fibres in the leaf margins, and in the tubular leaf base that sheathes the stalk. Notice the frilling of the leaf blade, especially near its joining with the sheath. Swing the whole leaf as far as possible, to find out what amount of play the leaf sheath allows by its own flexibility. What part of a circle is this play? Now hold the sheath tightly against the stalk, and find out the use of the frilling of the leaf blade. Pull the tip to left or right until the frill is straight. Reverse the direction, until the opposite frill is taken up.

How much play has the blade independent of the swinging sheath? What amount of play has the whole leaf?

The leaf has a spiral twist in its midrib that enables it to avoid the full force of the wind. The frills enable the midrib to turn to left or right, almost as easily as if it were hinged. By swinging round the stalk, and getting out of the way as much as possible, the leaves avoid the slitting they would get if they were flat and rigidly inserted on the stalk. Much protection is afforded by stalks standing in close ranks in the field.

The rain-guard is one of the neatest devices a corn plant can show. It prevents water from getting down between leaf-sheath and stalk. Dirt accumulating there would cause the base of the leaf to rot off. Dirt would injure the ear by getting down between the tender green husks. The guards prevent this. Rain flows down the leaf trough. The stream parts at the guard, runs down the swollen joint of the stalk, and trickles down the outside of the sheath. From one leaf to another it leaps, and waters the roots. Loosen a number of leaves, and study the rain-guard. Study them on the outer husks. Pour or spray an imitation shower on the top of a corn plant, and see the course of the streams as they descend to

the roots. See the accumulation of rubbish behind each rain-guard. Note the close fit of this process to the swollen joint of the stem.

Compare a green plant with one that is ripe and yellowing. Is the guard still doing duty? What effect have the surface hairs on the water? Does it collect in drops, as on an oily surface, or does it spread?

*The stalk.*—The swollen rings are the *nodes* of the stalk. The lengths between are the *internodes*.

The word *joint* is used for both, so is ambiguous. The strength of the stalk is in the short, strong internodes near the bottom. The slenderer, longer ones are toward the top, where flexibility is required rather than strength. Below each node the fibres are most rigid, but they are found more tender toward the bottom of the internode. In this tender substance growth takes place; and all the internodes of the stalk are able to grow at the same time. This explains the remarkable speed of the plant's growth, when the roots are established in rich mellow soil. Each "joint" adds to its own length.

Corn goes down, sometimes, before a severe wind that loosens its roothold. The chief work of erecting the prostrate stalk is done by the stout lower internodes, which have power to bend, and

thus lift the stalk. Have you seen corn, "lodged" by wind, rise again in a short time?

The corn plant's *feeding roots* are fibrous and shallow in rich soil. In pulling up a plant we tear them loose, and leave in the earth the delicate root-hairs. Above ground a set of special roots spring from one or more nodes of the stalk. These are *brace roots*, stiff and tough, provided to hold the stalk in the ground, and to brace it. They act as anchors as well as props, resisting the pull and push of the wind. How many sets of brace roots can you find on a single plant?

The farmer tries to hill the soil around the corn plants with his cultivator when he gives the last plowing. He knows that neither system of roots can do its work without a good grip on the soil. The deeper the roots are, the firmer the plant stands, and the better its chances to get food and water in abundance.

### KAFIR AND DURRA

Two sorghum varieties that are not sugar-producers have come to be extensively grown in the semi-arid regions of what was once our Great Plains. The merit of these canes is that they thrive in spite of drought, and they don't seem to

mind hot winds that shrivel the corn. The Kafir has its head erect; the Durra hangs its head. Thus, when one sees a field of stocky canes, like dwarf species of corn, the close, oval heads loaded with seeds, it is easy to tell if it is Kafir or Durra, the bold or the bashful one, the South African or the Egyptian "corn."

The seeds of these giant grasses are rich in starch, and in the Dark Continent are used as human food, as well as fodder, pasture, and dry grain for cattle. It was a shrewd traveller who brought the seeds to farmers on our western frontier where each soon proved itself a patient grass in a trying situation. Instead of succumbing to the drought and heat, the immigrant rolls its leaves up into the smallest compass, and calls a halt on all activities. When the spell of weather passes, and rain falls, the leaves unroll, and growth goes forward, just as if there had been no check.

Kafir has a reputation as poultry food, and ground into meal is a valuable part of the ration of fattening stock. The "yellow milo," a dwarf durra, is a great fodder crop in California and the hot, dry Southwest. If planted thinly, the stalks will "stool" like wheat, thus multiplying the crop by increasing the number of stalks.

A half-grown crop of durra or kafir makes good

pasture, but the full-grown stalks, even when stripped of seed, have more value as fodder. White-seeded durra is called "Jerusalem corn." "Kafir corn" and "African millet" are the same thing. The color of the seed glumes, or hulls, give the names to different varieties of kafir.

During any check in growth the leaves of sorghums contain a poison, hydrocyanic acid, that may kill cattle that eat the plant during this time. When the fodder is dry, the danger of poisoning has passed.

## MILLETS

In India, millet takes the place of rice in the dry regions of that vast country. A great abundance of small seed is borne in the thick spikes of certain robust grasses of several different kinds. In several oriental countries the food of the people is made, to a considerable extent, of millet seed. We know nothing about how it tastes and looks, for the millets here are raised entirely for feeding to cattle, or as a catch crop to plow under, for the enrichment and lightening of heavy soils.

Millets are ancient grains, the first that man gathered in the wild, and sowed seed of to get a better harvest on better ground. The seed is prepared in various ways: in porridge by boiling

the grain whole, or first ground into meal. Sometimes it is eaten raw; sometimes parched and eaten dry, or boiled in milk.

Hungarian grass, a fox-tail millet, is a good example of the group whose seeds are borne in compound spikes, each full as a heavy bunch of grapes, and crowded on the central stem, forming a long head that the stalk cannot hold erect. Pearl or cat-tail millet holds up its stiff, bearded spike, six to fourteen inches long, on a stalk that towers to a height of from six to fifteen feet. Such a plant can produce a wonderful amount of forage, and it may be cut three times a year in temperate climates. Its succulence prevents its quick curing as hay, and the quick development of tough fibres spoils it for hay if left till ripe. So farmers test the new plants to find out which ones are best for their needs. Millets may be the great American silage crop of the future. They promise well for pastures, and for green manure to sow after a grain crop has failed. The mixed bird seed sold for canaries contains some millet.

Poultry foods are enriched by an addition of Hungarian and Proso millets, both large-grained and as rich in protein as wheat. The Prosos are a group with better seed, but poorer as a forage plant.

## BUCKWHEAT

The most interesting thing about buckwheat is that it is not wheat, nor even a grain or grass. It is the seed of a plant of the Smartweed Family. We all know this pink-flowered smartweed that grows in swampy ground, and the knot-grass that creeps around the back door. The dock, sorrel, and pieplant belong to the same family. Buckwheat is an annual with slender, branching stem two feet high, bearing white flowers and a three-cornered, starchy "nut" in a brown hull.

Because the seed looks like a beech nut, the Old English "*buck*" (meaning beech), is combined with *wheat*, which originally meant white, in the name.

The triangular kernel is white and rich in starch, though deficient in other elements, and therefore lower in food value than the true grains. Yet it is grown extensively in many countries of Europe and Asia, ground into coarse meal, and made into porridge or cakes. The buckwheat cakes of winter mornings in the northern states consume most of the crop raised in this country. Several millions of bushels are thus used annually to make our "flapjacks."

The wild buckwheat grows on the banks of the

Amur River in Manchuria, whence it was carried into Europe five hundred years ago. The peasants of Russia raise five million acres of it each year. It has the advantage of hardiness, and ability to grow on very poor soil. Its season is short. Sowed after oats are harvested, it makes a crop, in some seasons. It is often put in as catch crop to plow under in the late fall. It ripens in the latitude of Sitka, Alaska, even.

Buckwheat hulls are sold as packing for bulbs and such things.

### BREADFRUIT

It is almost too much to believe — the story of bread that grows on trees! But people who travel in tropical countries have seen and eaten this wonderful fruit, and they tell us that the story is not a fable, but a simple, everyday fact. The natives go out and pick loaves of bread and bake them whole among the hot embers of outdoor or indoor fires. Then they open the crust and find the crumb part a rich, starchy mass that tastes to foreigners like mashed potato made rich by the addition of plenty of cream.

The breadfruit tree now grows in southern Florida, and bears its fruit there. So it is not

unlikely that we can all see the plant and taste the loaves that hang like melons, as large as one's head, from the axils of the huge, glossy leaves. They are like the big, green oranges that hang on the osage orange trees, and like the mulberries, which are made of a great number of tiny fruits, all grown together. These three fruits I mention for the reason that the plants that bear them are all near relatives in a big botanical family.

The breadfruit tree grows to be thirty or forty feet high in its home in the South Sea Islands. Its blossoms, like those of many other plants, are borne separately, the fertile ones clustered in globular heads, the sterile ones in club-shaped catkins. When the fruit ripens its surface is rough still, for the huge mass is covered with the aggregate tips of all the fertile flowers.

The cultivated breadfruits have become, like the bananas, practically seedless. The soft pulp is fibrous only at the centre. So its food value has been increased, at the expense of the seed-making function of the plant.

One of the romantic chapters of horticulture is the adventure of Lieutenant Bligh, who was commissioned by the British Government to go to Tahiti and get young plants of the breadfruit tree and take them to planters on the West Indian

Islands, in hopes that this valuable species could become established.

The good ship *Bounty* got the cargo of plants loaded, and sailed away, but the lieutenant was seized in mid-ocean by his mutinous crew, who put him into a small boat and set him adrift, with a sailor or two, who remained faithful, for his company. Back the *Bounty* sailed and reached the port from which it put to sea, and the crew made a settlement on Pitcairn's Island. But the plucky Lieutenant Bligh lived to reach England, and to head another expedition, which succeeded in carrying the breadfruit tree into the British West Indies, where it succeeded, and to-day is one of the most valuable of tropical fruits grown there.

It is one of the trees that grow best from cuttings made from new shoots. Unfortunately the fruit does not stand shipping as well as the cuttings and young trees, by which the species has been distributed very generally in the tropics of all countries.

Some trees feed and house and clothe people. Certain palm trees have this threefold value to the human race. The breadfruit tree is another. The inner fibre of the bark of young trees is made into cloth used for garments. The wood of the

trunk is used in canoe and house building. Seams of boats are closed with a glue made of the sticky, milky juice that exudes from wounds in the bark.

The fruit is often piled into pits, where it becomes a soft, ill-smelling mass. But it still is a nutritious food when baked. The better way to preserve the fruit for future use is to dry thin slices. These slices may be baked as they are, and eaten, or first ground into meal and made into puddings and other dishes.

## ARROWROOT PLANTS

The starch that physicians prescribe for children and invalids with certain forms of indigestion is called arrowroot. It is fine-grained, and has the peculiar characteristic of gathering into little balls when a pinch of it is rubbed between the thumb and finger. Stirred in boiling water, it forms a clear, odorless jelly, palatable and easily digested, if unadulterated in manufacture. Under the microscope the small grains are distinctly seen, and it is very easy to see the larger grains of potato starch with which the more expensive arrowroot is so often mixed.

Bermuda arrowroot is made from the fleshy rootstocks of a many-stemmed, reed-like plant

five feet high. Maranta is its name. It grows wild in Guiana, but it is cultivated in most tropical countries now, to supply the demand for this form of starch.

Maranta is a great crop in Bermuda, where the best grade of arrowroot is made. There is but one factory, and here each step of the process of manufacture is watched, to ensure absolute cleanliness. The tubers are scrubbed clean, then the skin is removed, and the white flesh grated and washed in many waters. The damp air prevents dust, and the water used is caught from rains that fall on the white roofs of coral limestone that cover all Bermuda houses. The more washings, the finer and whiter the starch that settles below the floating fibres of the roots. About 15 per cent. of the pulp washed is recovered as pure starch. This is dried under white gauze, in shallow pans. An average crop yields 14,000 pounds of tubers per acre, and the arrowroot sells for about 50 cents a pound in the open market, ten times the price of the same article made carelessly in St. Vincent, West Indies, and grown on soil not so good for the purpose as the coral rock meal of Bermuda, which produces the best possible tubers.

Neither the pointed rootstocks nor the dart-shaped leaves give the name of arrowroot to

Maranta. When the roving botanist first saw the root, a Mexican Indian, wounded with a poisoned arrow, dug up a plant, cut into a tuber, and applied the oozing sap to the spot where the arrow pierced the flesh. He did as all Indians did in that region, and knew no other use of the plant than to furnish this antidote for poison. It is strange that the German name for this plant, when translated, is the same. If a German traveller carried home the plant and the name, nobody remembers who he was, and when it happened.

The Maranta, grown in all tropical countries, produces arrowroot that is known in commerce by the name of the country that produced it. Hence, you can buy Australian, Natal, or Bermuda arrowroot, and so on.

One of the important recent discoveries is that arrowroot of excellent quality is made from the tubers of the various species of canna — our common garden and park ornamental plant.

Manihot arrowroot comes from the fleshy roots of a South American plant with a milky, poisonous juice. When this starch is separated from the fibrous tissues, it is dried and becomes a white powder. If baked on hot plates as it dries, it becomes a cake, which is broken into small bits, and these rounded by friction on each other, as

bits of hardened clay are made into marbles. We know this arrowroot as *tapioca*, a nutritious food, very good for babies and invalids. Cassava is the common name of this tapioca arrowroot plant. Manihot utilissima ("most useful" Manihot) is its botanical name. "Manioc," and "mandioca," are two names by which the plant is known in South America, its native country. It looks like the castor-oil plant as it grows, its stem giving off branches in threes. The fleshy roots, like sweet potatoes, are often six to eight feet long. They are poisonous, if eaten fresh, but the poison is driven out by heat and pressure.

Sliced and dried, then rasped or ground, they furnish the "cassava meal," out of which the cassava cakes of the tropical countries are made. Cassava bread is the same. Mixed with molasses and fermented, the meal is a part of an intoxicating drink.

### SAGO PALM

Pearl sago is a form of starch much like tapioca, used for puddings, and various foods for convalescents and children, because it is a form of starch that is easy of digestion. It does not come from roots nor tubers, as much starch does, nor from seeds, as does the starch made from corn and other

grains. It is obtained from a number of palms, particularly from one species.

The sago palm grows in the East Indies, in swampy ground near the coasts. For fifteen years it grows without flowering, the stem topped by a crown of feathery leaves. The pith of the stout trunk is surrounded by a thick rind, and when the time of maturity arrives, it is simply bursting with rich, starchy material. This is the tree's reserve, laid up for use in sending up the flower cluster and ripening the fruit. Let the tree keep to its natural function, and the rind will stand, a hollow shell, the leaves dead and the ripe fruits fallen, at the end of the year of blossom. It is the tree's time to die.

The sago palm is too valuable a tree to be left to round out its own career by going to seed. Just when the stem is loaded with starchy pith the sago hunter has it cut down. Systematically the trunk is sectioned and then split, and the rind scraped of all the pith, which is grated to a pulp. Next, the pulp is worked with the hands in troughs full of water, until all the starch has settled to the bottom, and only dry fibre remains. Separate washings rid the starch of impurities, and it is dried. Now it is ready for use in the cakes and soups upon which the natives live.

Sago in commerce is in the form of small pellets. The native prepares the floury starch for export by working it up in a paste with water. Then he forces the paste through a sort of colander or sieve, and it dries in small bits. Different sizes have different trade names, but all sago is the same substance, a valuable starchy food.

# Forage Plants

## CHAPTER II

### Grasses

A large part of the animal creation is made up of grass-eaters. Carnivorous creatures live upon the grass-eaters. So the saying: "All flesh is grass," is literally true, in the long run. The commonest plant in the world is grass. It covers the bare earth, even when trees and other larger plants make a shade over it. Grass fills in the chinks, and makes the earth green and beautiful, except in desert places.

The Grass Family embraces all the cultivated grains, whose seeds make flour for bread of many kinds. It covers the pasture grasses that are made into hay to feed stock in cold winter climates. The blue-grass, that makes Kentucky famous, and is the favorite lawn grass in all our cities, is a wild species. Its nutritious leaves and stems make the richest kind of pasture and hay for stock.

Timothy and red-top, European wild grasses, we cultivate for hay and pasture. Each country has developed its own types of forage plants.

The stems of grasses are round. Three-cornered stems belong to the sedges, which are more near to the rushes, that grow in wet ground. Sedges are woven into matting by the Japanese. Rush matting is made in many countries.

A reed called Papyrus, that used to be cultivated in the Delta of the Nile, was more important in the early ages of civilization than it is now. Sheets made of thin, overlapping strips of the pith formed the first paper used for the manuscript records. Other materials have quite superseded Papyrus in the manufacture of paper, but its name is preserved for all time in our English word, paper. We see the plant occasionally in water gardens, and in pools where goldfish live outdoors.

### CLOVERS

Grasses include the cereals, the bread plants of the world. Because they furnish rich food in both forage and grain, these plants are great soil robbers. They give back little or nothing. The farmer must constantly fertilize his fields, or the yield of grain falls off deplorably. Nitrogen is the most needed element. It can be bought in chemical form and spread on the land, plowed or allowed to wash in, and the crop will reward the

farmer by increased yield. But this form of nitrogen is expensive. It averages 15 cents a pound — a high price to pay.

By planting some nitrogen-gathering plant in rotation with his grain crops, the farmer puts nitrogen back into the soil at a merely nominal cost. Clover is one of the best soil restorers. It is a nutritious pasture, or hay crop. Its roots go deep and pulverize the soil. They gather nitrogen and store it in nodules along their fibrous branches. When growth ceases, the hay is cut and put into the barn; those nitrogen-laden roots are left to decay and enrich the soil for future crops. The surface crop is worth much, for its nitrogenous content is high, and when animals fatten on it, much of its value is twice saved by careful spreading of the stable manure on the fields.

Four fifths of the air is nitrogen. Clover plants have power to gather this element and store it in the nodules on their roots.

Long before farmers had ever seen the tubercles on the roots of legumes (pod-bearing plants) they knew that clover was the best means of renewing worn-out land and enriching any soil. Fortunately, experience was their guide, though, until very recently, they followed blindly. One of nature's best gifts to agriculture is this group of

plants that constantly renews the soil's fertility.

Two hundred species of the clover are known to botanists. The hairy, red clover we know as a hay and seed crop, that may be cut early for hay and late for seed the same season. In pasture it "runs out" in two or three years. The mammoth red is an improved kind.

This is not a bee pasture, as the white clover is, because the tubes of the little flowers are too deep for the honey-bee's tongue to reach the sweets. The bumble-bee has a longer tongue, and by this insect the pollen is carried that insures a heavy yield of seed.

The bumble-bees are very scarce in June, when the red clover comes into bloom. In late summer the clover fields swarm with these insects. Hence, the farmer makes hay in his clover field in June, cutting the succulent stems when they are in the right condition to make the best hay, which is too early for any seed to be ripe. In late summer he sacrifices the quality of the forage to get his clover seed at the time that is ripe. He owes this heavy crop to the bees, though he may not know this, any more than they do.

Alsike, or Swedish clover, grows well on land too wet for the red clovers, and makes superfine hay,

pasture, and honey. Its small heads are white, with a tinge of rose. Its stalks are slender and branched. The honey-bees have no trouble in getting the nectar.

White clover creeps into pastures of grass, and lifts its small, white heads on long, unbranched stems. It is wild all over this northern half of the United States, and nobody pays much attention to it, as a rule.

The most beautiful species is the crimson clover, with long, crimson heads on slender, tall plants. It is used as a cover crop in orchards, and as forage, but is not a heavy crop. So it is less frequently sown than other kinds. It grows wild in parts of southern Europe, and is a staple forage crop in parts of Italy.

Berseem, the yellow-flowered clover of Egypt, is one of the plants recently introduced that promises well as a forage crop for dry regions and unpromising alkali soils.

Clovers will not thrive on sour soils. Such must be sweetened with applications of lime. There must be phosphorus and potash added. Then the roots pasture greedily, plow the soil, unlock the mineral foods the earthy particles hold, and make the soil swarm with nitrogen-gathering bacteria, so that it is literally *alive*.

## ALFALFA

"Lucerne" is another name by which this wonderful clover-like plant is called in Europe, but in America we call it by the Arabic name, "alfalfa," which means "the best fodder." That name describes it exactly, for no other plant yields as much and as good hay.

All the western half of the United States grows alfalfa. The plant has brought under cultivation land supposed to be too dry to grow any farm crop. No matter if the region has scant rainfall. The farmer cultivates the land carefully, preparatory to seeding. He may scatter soil from another alfalfa field on his own to inoculate the soil. He will scatter plaster on the land to sweeten any sour patches. Then he sows the alfalfa, and may mow it when the plants are several inches high to get rid of the weeds and to induce the alfalfa plants to "stool." They send up a good many supplementary branches, which choke out weeds, and cover the ground, producing an abundance of leaves.

The root does the most wonderful thing. It is a strong tap root, and it goes down for water. Its many branches penetrate the soil, loosening it, and making it spongy, and able to hold the

moisture it receives whenever rain falls. It is not unusual for single plants of alfalfa to have roots fifteen to twenty-five feet long, burrowing down to stores of moisture that no shallow-rooted plant could get at.

Alfalfa is one of those nitrogen-gathering plants, extracting the most precious of all the elements of plant food from the air, and storing it in nodules on the roots. When a plant dies its root decays, and the soil is enriched by the nitrogen the nodules set free. The fibre of the roots makes humus. The roots have mellowed the deeper subsoil, and brought up plant food to enrich the surface soil for other plants. If the plant is left to rot, it, too, adds fertilizer. But usually it is taken off in the form of hay. The alfalfa plant gives back valuable elements to the soil, and leaves it in better condition for the growing of such exacting crops as corn and wheat.

Another wonderful fact about alfalfa is that it is perennial: once established, it continues to grow in the same field, without "running out," for ten to thirty years. And each year two to seven cuttings of hay are made from the same field. An average cutting yields between one and two tons of dry hay. The average yearly yield is four or five tons of dry alfalfa hay per acre. In all

regions it goes far ahead of grass. In southern California some irrigated fields yield ten tons to the acre, where grass, with the same care, yields two to four tons only.

Nothing is more beautiful than a field of alfalfa ready for cutting. The plants stand less than two feet high, covering the ground with a velvet carpet of dark green, tinged with the deep blue or purple of the dense flower clusters, just beginning to show their color. The plants branch thickly, and the abundant foliage is made of clover-like, three-branched leaves. A single flower is like a pea blossom, and each ripens, if it gets a chance, an interesting flat pod that coils itself as tight as a watch spring.

Alfalfa hay is cut when the flowers bud, and before fibre hardens the succulent leaves. Carefully dried, the leaves make hay that is at its best. The leaves are very rich in protein, the nitrogenous element that builds flesh. The stems and flower clusters are nutritious, too, but at haying time it is the leaves, which shed badly if not properly dried, that the farmer is most concerned about.

Alfalfa fields make rich pastures, but hungry cattle eat too much and get sick, if they have their own way. Cattle-raisers feed the hay ground up and added to corn and bran. Such a balanced

ration is an exact way of feeding, which is most satisfactory. Bags of this alfalfa meal are shipped more economically than the same hay baled.

I have eaten very palatable bread and cakes made of alfalfa flour — the ground seed. It is nutritious, but too dark colored to be popular.

Records show that alfalfa was brought into Greece from Persia in 480 B. C. It reached Italy during the first century, and slowly spread over Europe. From Spain it was carried to Mexico and thence spread north and south during the sixteenth century. New England got seed from England about the same time. But the plants died out the second season, and culture of the new plant was generally ignored by farmers. Only recently has it been restored to a place among agricultural crops in the East by the discovery that soil inoculation establishes the plant, and it becomes one of the best crops for forage, and for building up depleted farm land.

In the West, alfalfa is the great forage crop, as it is in southern Europe. Drought-resistant varieties brought from Turkestan are grown in the semi-arid regions of the Great Plains, and the desert places become gardens. Hardier varieties have extended the range of the plant farther north.

*Sand lucern* is proving just the thing for light, sandy soil in the north central states.

The growing popularity of alfalfa in Kansas is shown by the fact that in 1891 the crop measured 34,000 acres. In 1907 it was 743,000 acres. The prejudice of farmers is strong against a "new thing." But even prejudice must surrender when the new plant multiplies the farm income, and at the same time improves the land.

Sugar Plants

## CHAPTER III

### Sugar-cane

Tallest and most valuable of all grasses is the sugar-cane, which grows to a height of twenty feet, in the most favorable situations, and furnishes one of the most important of human foods. Its name, Saccharum, gives us a root for words that mean sweet; and it is the adjective part of the Latin names of several other plants whose sap yields more or less sugar.

The cane is very much like maize in general appearance, except that the "joints" are shorter and the leaves narrower. When the time of flowering arrives, the stalk is topped by a full, oval plume, like that of pampas grass. The sections of the stem are covered by a tough rind, and filled with soft pith, strung with thread-like fibres, and saturated with the sweet sap. The time when the percentage and the condition of sugar is best is just at the fading of the flowers. After that the plant draws upon the store of rich sap to mature the seeds.

The grower is little interested in seed-production. When the stalk is cut, new shoots come up from the roots — the "ratoons," from which the new crop comes — sometimes for a long period of years. Another means of getting new fields planted is setting out cuttings. Any joint is likely to root, if planted, and it may send up a number of canes. The top of the cane is always deficient in sugar, and best for making cuttings. This fortunate combination of facts enables the grower to send the best of his crop to the sugar mill, and keep back the part of the canes that insures the best crop next year in the new field. Two joints to a cutting, and the cuttings set out in a horizontal position, are the usual methods on the up-to-date plantations.

Only in the tropics does the cane flower at all freely. Many of the varieties grown do not flower at all. This condition has arisen from the continued propagation of new plants by means of cuttings and ratoons.

A plant that is commercially grown in all tropical and sub-tropical countries of the globe, by peoples ranging from civilization down to savagery, receives varied treatment, before and after completing its period of growth. In general, then, we can speak of the cultivation

The loaf that hangs on the bread-fruit tree is as large as a man's head

Cultivating sugar-cane by machinery in the South

and harvest of cane, and the manufacture of sugar.

During the ten months between the planting and harvesting of sugar-cane it is kept free from weeds, and the soil mellow to retain moisture. The fields must be irrigated if good crops are demanded in regions of insufficient rainfall. The lower leaves are often stripped to let in the sun, and make the canes stand up better. When tests indicate that the time for cutting has arrived, the men go into the harvest with machetes, or other stout knives. The stalks are cut near the ground, for otherwise much sugar would be lost. The part of the field earliest to get a start in spring is the one earliest ready for the knife. This is fortunate, for the canes cut must be crushed in the mill soon afterward, or they will quickly deteriorate.

The growth in the cane brake is tremendously heavy, and for this reason the most enlightened planters take advantage of inventions that carry the canes to the mill. Barges, if water is near, trolleys, lines of railroad with open cars, even flumes, are means of transportation made use of to save expense in time and human muscle.

The improvement of machinery from the puny wooden wheel crushers, driven by mule or buffalo power, that left a large percentage of the sugar in

the stalks, to the power mills that get almost all, has done much to create, as well as supply, the increased demand in the world for sugar of the highest quality. In the cane mill and on through the sugar factory we see skilled men controlling the machinery that converts cane sap into sugar. Few processes require human labor, such as is put into the business in countries where more primitive methods are still in use. The improvements have been made by men who have gone into warm countries from the North, and taken vigorous hold of the business. Teaching the easy-going inhabitants the use of machinery has been a chore.

The sap of the cane must be extracted by crushing and rolling, then condensed by evaporating the water it contains, then clarified and crystallized into the sugar of commerce.

The best mills get 95 per cent. of the sucrose (sugary content) of the cane. This process begins with the carrier that brings a continuous supply of cane to the shredding knives. The torn fibres go to the crushing rollers, a series of them, that finally leave the dry fibre, called "bagasse" in America. This is burned in the furnaces for fuel, or saturated with the sweet residue of the sugar vats, and sold as a cattle food under the trade name, "molascuit." A recent use for the fibre

is as a filtering material for the clearing of the liquid sugar.

Vacuum pans rarefy the air so that the contents boil at a low temperature, which is the only way to keep all the sucrose in the chemical state to crystallize when the proper degree of condensation is reached. When crystals begin to form in the pan, the process goes forward rapidly, and the mass is quickly cooled, and the crystallized sugar, in a small amount of liquid, is let out into centrifugal separators, with fine metal gauze in their linings. These vessels revolve at high speed, and the molasses flies out through the screens, while the granulated part of the sugar remains behind. It is just as we see it in the markets. If the molasses is not all thrown off, we have a moist sugar, instead of the granulated, dry kind.

Molasses is made by heating the cane juice to a temperature that converts much of the sucrose into "invert sugar," a form that will not crystallize. So sweet and rich is the syrup that it has great food value, and is one of the valuable by-products of sugar making, in all the old processes. Only the vacuum pan prevents the formation of invert sugar, and the molasses resulting from this process is almost worthless as food. The fermentation of this low-grade molasses produces

alcohol fit only for industrial uses. The rich molasses, diluted with water and fermented, produces rum.

### SORGHUM

By the name, Sorghum, we in America mean the sugar-bearing variety of the species, *sorghum*, which is big enough to include the broom corn and the kafir and durra, inaccurately called *corn* and *millet*.

The hard times that kept farmers poor in the West thirty or forty years ago, made sugar a luxury that they could not afford. The plant upon which a good deal depended in those times was the "amber sorghum," from which sorghum molasses was made. Every farmer planted a small patch of cane, and when the slender stalks had ripened their feathery panicles of flowers, they were stripped where they stood. Then they were topped, after being cut down, and the part that contained the soft pith, saturated with sugar, was hauled to the mill. This was a crude affair, installed by a neighbor who *ground* and *boiled* for the community, if he could spare the time. A crusher consisted of steel cylinders between which the canes were fed, while a horse went round and round to furnish the power. The sap was caught below the crusher, and conducted to a

reservoir, or directly to the evaporating pan, under which a fire burned, while the man attending it skimmed the boiling liquid to get rid of the impurities in it. Eight gallons of juice made one of heavy syrup. The strong taste was partly due to the leaf fragments and other foreign matter that made 25 per cent. of the crude sap.

To-day, cheap glucose syrups have replaced the molasses of frontier memory. But they are not so honest as the darker, heavier molasses. The gingerbread and molasses cookies of our grandmothers' day cannot be equalled by any present-day treacles. The farmer affords sugar now, and therefore the manufacture of molasses has fallen off in country districts, and the crushers rust in the junk heap.

This sorghum came originally from Africa by way of Egypt, and an importation of seeds brought it also from China, to be tried as a fodder plant in drought-stricken regions of the Southwest. Here it is still grown for forage and for syrup. Half-grown canes are pastured and made into silage. It out-crops the best varieties of fodder corn.

### SUGAR BEETS

A number of vegetables contain a noticeable amount of sugar. The onion is one of these.

Peas and corn are sweet. Stalks of corn yield sugar. Fruits of many kinds have a high percentage of sugar. Grains and root vegetables must also be counted, and the sap of many species of trees.

But the world's supply of sugar depended from the beginning of civilization, and probably long before, upon the sugar-cane of the Tropics. It is not strange that the more progressive peoples of temperate regions came to feel a fear that this important foodstuff might fail, in time, to supply the growing demand. Tropical agriculture is not scientific. Coolie labor produces the crop of cane, and the overseers are not men who would direct a fight against a new disease or insect enemy of the cane as men of colder regions would. What would a sugar famine mean?

The question confronting the scientist and the commercial world was this: Isn't there a sugar plant of the Temperate Zones to take the place of the cane? Nobody could name one. The next question was: Cannot a sugar-producing plant be bred up to fill the great need?

Germany and France furnished the trained scientists whose patience and skill solved the problem. Vegetables of various sorts were tested for sugar. Beets were found that tested as high as

3 per cent. sugar. It was decided to work for the improvement of the beet as a sugar plant.

Seed of the plants that gave the highest sugar test were saved and planted. The new crop was carefully examined, and only those saved to produce seed which had most promise. Again and again the process of seed selection was repeated, and very gradually the sugar content rose. The establishing of beet-sugar mills and the perfecting of processes of extracting and refining the product did not interfere with the work of improving the strains of sugar beets. It is still practised. Every beet seed grower with enterprise is at this work, bringing the strain he sells to a higher sugar content. The average per cent. has doubled in the past hundred years. Individual beets have tested as high as 25 per cent. That means one quarter of the beet's weight is sugar. Fields have averaged 14 per cent.

Beets are furnishing to-day a large part of the sugar of the world. The amount of sugar consumed has greatly increased within fifty years, so it is fortunate that a second source of the raw material for its manufacture has been found. Europe is far ahead of America still in the beet-sugar industry. California and Colorado are the chief sugar-producing states. The natural advan-

tages of a mild climate with plenty of sunshine give California the advantage. The beets contain a higher percentage of sugar than those of any other country. The season lasts practically throughout the year, which keeps the mills busy, and a vast army of workers continuously employed.

The beets are planted in rows with a drill, and carefully tilled. They are dug by machines, but hand work is required to cut off the tops with the leaves attached. Slicing by machinery follows.

The pulp left after the sugar has been extracted is put down in silos, or fed fresh to cattle. The molasses is converted into alcohol.

### SUGAR MAPLES

The making of sugar from cane and beets requires elaborate machinery. It is no simple home industry. But anybody who has a few sugar maple trees, and a fair amount of patience, can make maple sugar as good as any. The rich, sugary sap begins to flow early in the year. Holes are bored into the saturated wood to lead it out into buckets. The hollow drainpipes first used were "spiles," made of the large-pithed elder-bush, and driven into the holes as they were bored.

Now spouts of tin or galvanized iron are used. Drip, drip, falls the sap into the buckets, and every day it is gathered for boiling. The trees may run for some weeks.

Maple sugar has a peculiarly delicate flavor, that adapts it for use in the making of fancy desserts and confectionery. In the markets it commands a price far higher than cane or beet sugar, even when dark in color and strong in flavor. Constant boiling of the syrup, and faithful skimming produces the best quality of sugar, and the lightest color. Much of the year's crop is sold as syrup, canned before it reaches the density required for crystallization.

A delightful variation from the gritty brick sugar and the syrup is maple cream, a smooth, fine-grained, almost white paste, made by stirring heavy syrup with a wooden paddle.

The hard or sugar maple, and a closely related species, or variety, called the black maple, are the two principal sources of maple sugar. It is, therefore, an American product, bound to dwindle in amount from year to year by reason of the cutting off of the forests in the northern tier of states. Vermont and Ohio are perhaps the largest producers now. The maintenance of hard maple groves will always interest a few people who supply

their own needs in this way. Canada makes a good deal of maple sugar still.

It is interesting to note that the savages of our northern woods supplied themselves with maple sugar, just as the tropical savages get this needed food from palm trees and sugar-cane.

Soft maples yield sugar, but not in quantities that pay for the hard work of evaporating their thin sap.

# Plants Whose Seeds We Eat

## CHAPTER IV

### Beans

The person who "doesn't know beans" is counted a stupid one. You and I know the little white dry beans that began to be grown as a field crop to supply our army during the Civil War. This is the bean that supplies our navy, too, and one name of it is, "*Navy bean.*" Boston bakes this bean, and it is a staple food for man and beast.

We know the garden beans whose pods we eat —*snap* and *butter beans*—beans that grow in bush form and others that climb poles. All these kinds are sprung from one species, probably native to South America, and spread to India, Egypt, Asia Minor, and Europe, following the Spanish invasion of Peru. The general name, *kidney bean*, is applied to this group, varieties of which are the food that substitutes for meat in warm countries, swarming with a great population.

We know *Lima beans*, the broad-podded, flat kind, bigger than the kidney. It is a separate

species, called *lunatus*, the moon-shaped bean, credited to South America, and named for the city of Lima, the Peruvian capital. It has bush and pole varieties, and some especially delicate dwarf kinds have been derived from the original large-seeded species.

The *scarlet runner* is a distinct species, grown chiefly as an ornamental vine, that covers trellises and porches with its abundant flower-clustered tendrils, vigorous, bright foliage, and wholesome seeds, that are good to eat, in the green pods or dry. In this country they are rarely used for food.

We in America do not know the *broad bean* of Europe and Asia, unless we live in Canada, where this rich vegetable is grown to mix with fodder corn in making ensilage. The whole plant is rich in nitrogen, and it goes into the silo, leaving the roots with their store of nitrogen in the tubercles, to fertilize the soil. The dry beans are used in the old countries as cattle food. Usually they are ground into meal and mixed with coarser, less concentrated food. Housewives put down pod beans of different sorts in brine for winter use. The custom is an old one in England, Germany, and the Low Countries. Though a coarse vegetable fare, beans are almost one fourth protein, or

muscle-making food. They also contain oil, which is a heat-producing food, suited for people who work outdoors in cold weather.

We are beginning to know the strange *Soy*, or *Soja*, *bean* from Japan and China, a native of these countries, and cultivated there and in India for centuries unnumbered, as a food for man. It is more like a pea than a bean; the seed and the whole plant are rich in nitrogen. They are used for stock food, and plowed under to enrich the soil. Cowpeas are very like Soy beans, and put to the same uses.

In Mexico and farther south the little dark beans, called *frijoles*, are a common food of the people, as the horse beans are in the warm countries of Europe.

## PEAS

Fully as ancient as the bean, as human food, is the pea, records of whose cultivation are found in the lake dwellings of Switzerland and Savoy, and in the early classic writings. No mention of peas is made in the records of early times in India or Egypt. So the fact that wild peas still flourish in Mediterranean countries is taken by botanists to mean that this region is the ancestral home from which one of the most valuable garden

and field crops of the world has spread through the temperate regions, everywhere.

Field peas are grown as a green and a dry crop for stock, as pasture, ensilage and as green manure. Foreigners are not above eating them, but we feel squeamish about it, though as split peas we do consume in soups field peas without knowing it.

Garden peas are more delicate and sweet, and we consider these, in a multitude of varieties, among the choicest and most nutritious of all vegetables. Quantities are canned commercially, the smallest being the most expensive, the *petit pois*, of French cookery. We must believe that the sifting out of imperfect, undeveloped seeds of standard canning varieties supply a product that is inferior, and yet this grade often poses as the imported article from France.

A tremendous acreage is planted to peas as a market garden crop. The gardeners of all countries grow them for home use. They are a great crop for soil renovation, and for green manure in young orchards.

The sugar peas have sweet, edible pods, and are used as snap beans are. Among the numerous varieties, those that have wrinkled seeds are sweeter and have less starch than those that are globular when dry.

Enlarging the holes to strengthen the flow of sap from the maple trees

Garden peas are a hardy and prolific race

Sweet peas are a race developed for their blossoms alone.

### LENTILS

One of the oldest food plants that supplies in satisfying quantities the muscle-building elements is the lentil, a puzzle to the botanist, but cultivated by men as far back as the Bronze Age. We are familiar, perhaps, with the little, dark, flattened seed, that the grocer keeps chiefly for his customers of the Latin races. They have no prejudices against foods that are dark-colored and have a strong taste. We can buy canned lentils, ready to eat, and learn what they taste like, or make soup of the dry seeds that act and look like small, dark split peas.

Any vegetable that has saved the race from famine, and came with the Aryan civilization into Europe, and on to this country, is one worth knowing, from a historical standpoint, if from no other. There are so many legumes far more useful, however, that it will be surprising if the lentils should not decline with the advance of civilization in the years to come.

The lupines and vetches, pod-bearing plants once important as food for cattle, have value, but better forage plants will surely beat them in the

race. Some species may fit peculiar situations, and be improved for this purpose. But only the fittest plants survive in the new, intelligent agriculture that is coming on.

## PEANUTS

The young gardener who plants, just for fun, a peanut or two, to see what the plant looks like, realizes, when it comes into bloom, that he has something that might easily be mistaken for a bushy bean or pea plant, with lower branches that creep along the ground in all directions. The familiar pea blossoms settle the question of the family before the seed shows. The plant is a pod-bearer. Its fruit is not a true nut at all.

Another discovery that pleases the average boy and girl is this: the peanut will grow almost anywhere in this country, and produce plenty of "nuts." What a tremendous saving of nickels and dimes! For who goes out for a holiday without patronizing the peanut man, whose neat little pushcart whistles cheerily on the street corner? Mothers would much rather have their hungry children comforted with a bag of warm, fresh-roasted peanuts on the ride home, than with sweets that are made of she knows not what.

The peanuts are wholesome food, nourishing, as well as tasty, and they are shelled as eaten, which means that they have not been crawled over by flies. They are easily handled and do not mess one's clothes and hands.

Grown-up people are as fond of peanuts as children, and frankly buy and eat them even in public places, if they feel so inclined. The more particular people will take them home where they can enjoy them with the rest of the family.

A more recent use of the nuts — roasting them in butter or oil — makes an appetizing dish.

Peanut butter is a comparative novelty, made by grinding the roasted nut to a paste. It will not supersede butter made from cream, though many people use less of the latter since they have learned to like peanut butter on bread.

Peanut oil is extracted from the nuts and used in cooking, and as a salad oil. At first the taste of the peanut was in it, but refining has taken that away. The great mill at Marseilles, supplied from the fields of Spain, India, and North Africa, was long the chief manufacturing plant for peanut oil, but now mills are being established in peanut-growing states.

We eat cottonseed oil that has travelled to Europe and comes back labelled "olive oil." No

doubt much "pure Lucca oil" we buy, and pay very high prices for, is made chiefly of peanuts and other things not so good. The sooner we are willing to take our honest products, the oil of cottonseed and peanut, on their own merits, the less we will have to pay for these foodstuffs. Then we shall cease to pay tribute to pirates who call by the name, olive oil, a table oil that is not genuine, but adulterated. It is time we laughed at them: so long have they laughed at our boast that we will have nothing but the genuine article, and that we are able to detect the first attempt to cheat us by substitutions.

Let us take a long look backward to see how it came about that the peanut is the principal nut used in America to-day. We do not have so long a way to go to find a day when people outside of a small section of Virginia knew nothing about the "goober pea," so well liked by the people around Norfolk, where the light, sandy soil was commonly planted to this crop. In the early sixties, when the northern armies were in Virginia, the boys in blue from many sections of the country fell in love with the nuts that were a food as well as a kind of dainty, and lent pleasant variety to the hard fare of the soldier life. They could keep a supply on hand, and even on the

march found a pocketful no burden, and often a great boon.

It was the soldier mustered out at the end of the war that sent back to Virginia for seed, and he planted peanuts on his farm to let the home folks taste that "goober" he had talked so much about. So the northern peanut appetite was a by-product of the War of the Rebellion.

The centre of peanut culture is still near its starting point, Virginia. North Carolina and Virginia each raise over four million bushels a year. Georgia raises half as many. Thirty-eight states can grow goobers. The crop brings over ten million dollars a year. We Americans eat all the nuts we raise, and import quantities beside from Spain, and from China and Japan! We certainly have the peanut habit!

There will come a day, perhaps, when we grow all our peanuts at home. It is expensive to bring them from abroad. The Pacific coast has begun to grow great crops in the sandy soil of the Great Valley of California. Home-grown nuts will soon supply the market on this side of the mountains. Texas is growing stupendous crops of Spanish varieties, which yield three times as much as the Carolina and Virginia fields average, by the easy-going methods of culture in use. Tennessee

is another of the eight states which grow peanuts seriously as a big money crop.

The botanist has gone farther than we have in tracing the peanut to its original home. How did it come into Virginia, and when? The records say it was the chief food supplied on "slavers" to the natives of Africa on their way to America, and the auction block where they were offered for sale. So the peanut and the negro came together from Africa in early colonial days. We have already mentioned India, Africa, and Spain as countries that export the nuts. Brazil is considered the original home of the peanut, because a half dozen species of the genus grow wild in that great region. Taking the botanist's word for it, we recognize in the humble "ground-nut," a cosmopolite, whose travels have satisfied it that North America is a good country to settle in.

The most interesting thing about the peanut plant is the way the blossoms look and act. The foliage is thick, but the leaves do not conceal the showy, yellow flowers that fade, one after another, and do not bear a single seed! The flowers that "mean business" are almost too small to see at all. They do not open, and have no showy color. As soon as they are fully grown they tuck their pointed tips into the ground, and work out of

sight. Unless they do this the nuts will not develop and ripen.

When the autumn comes, the plant is still flowering, and the grower hates to pull up a plant that has not finished bearing. But he does it. The late flowers form small nuts at best, and it is dangerous to take chances of an early frost that will damage the vines and interfere with the curing of the nuts.

A furrow is plowed to throw the earth away from the row on each side, and the plants are then lifted with forks, and the dirt shaken off the clustered nuts massed among the roots. Long windrows of the loaded plants are gathered up by gangs of harvesters, and shocked around poles set firmly in the ground. The nuts are faced inward, so that they are protected by the tops, and a cap of grass roofs them from the rain. When dried the nuts are picked by hand or threshed out by machinery, cleaned of sand and rubbish, bleached, if they are discolored, and sent to market.

The chemist has told farmers some startling things about the peanut. They are full of meaning and interest to us all. It would pay to grow peanuts even if we never harvested the nuts, because the plant is one of those nitrogen-gatherers, which absorbs that most valuable of all plant foods,

nitrogen, from the air that is in the soil, and stores it in nodules on the roots, and in the stems and leaves. Plowing under such a crop adds to the soil the best possible green manure. After the nuts are taken off the dry plants are as rich stock food as clover hay. The hulls of the nuts are better than coarse hay. The cake left after pressing the oil out of the nuts is as good for fattening stock as cottonseed meal and linseed meal. It has three times the richness of corn. All kinds of stock like the taste of peanuts, and thrive on the food, green or dry.

The farmer has every reason to bless the slave trader who imported the peanut, for it brings millions of dollars to his pocket every year, and the refuse feeds his stock, which makes it, indirectly, a money crop. The elements of nitrogen, phosphoric acid, and potash, in which the plant is rich, finally go back to the soil in the barnyard manure, thus saving money which would otherwise have to be spent for other fertilizers.

### ALMONDS

Strangest of all the stone fruits is the almond, for its flesh dries away into a leathery husk that cracks open when ripe to free the pit. We do not throw away the pit of the almond as we do that of

other stone fruits, for it is good to eat. Almonds are among our most wholesome and most delicious nuts.

Two kinds of almonds are grown, the sweet and the bitter. The first is the edible one; the second yields a flavoring extract used in cookery and in perfumes. The pits are ground and mixed with water. The oil that contains the peculiar flavor is then steam-distilled, and afterward freed of its poison, hydrocyanic acid.

The paper-shelled sweet almond is the one the market demands, so it is the principal kind raised. It has been produced by careful selection from the stubborn, hard-shelled kinds first derived from the wild almond of the Mediterranean countries. Sweet almond oil is an article obtainable in drug stores.

The flower of the almond trees is like that of the peach, and for this reason the tree has been planted as an ornamental wherever it is hardy. The trees bear fruit only in warm climates. In this country the greatest areas devoted to the cultivation of the sweet almond are in the high coast valleys of central California. The bulk of the trade is still supplied from the old almond-growing countries of Europe: Spain, France, and Italy leading. Morocco ranks with them.

When the nuts are ripe, the husks split open. Then the branches are shaken or beaten, the fruit dropping on canvas spread under the tree. The almonds are hulled by machinery, and then dried, and bleached by sulphur fumes. This process is foolish in the extreme, as it may spoil the flavor of the nuts if any miscalculation is made. The shell easily discolors if it stays on the tree later than the time the husk breaks. Since shell discoloration hurts the sale, bleaching is resorted to. The Public pays the price of this extra process, because it imagines that almonds are not first class unless they have bright yellow shells!

### AMERICAN WALNUTS

A dozen different kinds of valuable trees belong in the family of the walnuts and hickories. They are fruit trees, for most of them bear edible nuts — pecans, English walnuts, and shagbark hickory nuts, for examples. They are noble shade and valuable lumber trees. So they have been planted and highly esteemed from the time that men first began to use the fruit and the wood of trees.

The *Black Walnut* bears globular nuts, wrapped in spongy husks, smooth and green, like little

oranges, clustered on the ends of twigs, and surrounded by whorls of the long, compound leaves. In fall these fruits drop and the husks soften and break, but the hard sculptured nut shells defend the kernels from the enemies that may destroy them. Squirrels must gnaw, and small boys must hammer to get through that solid, wooden wall. The planter always cracks the shell, to help the seed to get out when it sprouts in spring.

The second American walnut, also an eastern species, is the *White Walnut*, commonly called, from its oily kernel, the *Butternut*. The fruit is a long, pointed nut, dark-colored, and deeply sculptured. The fuzzy, clammy, green husk leaks an aromatic juice that stains the hands of the nut-gatherer scandalously, if he doesn't take care. This fluid made the dye the housewife used in old times to color homespun woolens to the butternut browns, common in men's suits. The green nuts were rubbed free from their furry coverings, and pickled. They make a fine sauce with meats. The nuts are rich, but they soon become rancid. This takes them out of the list of commercial nuts, but they will always be a treat for country boys and girls to eat with roasted apples and cider, around the open fire.

## ENGLISH WALNUTS

Names have interesting histories. The English Walnut came to the Boston and New York markets from English shipping houses, before commerce had established more direct lines of steamships between the United States and the southern ports of Europe, and before California began to supply the country with home-grown nuts of the same kinds. English walnuts, indeed! Not a nut ever ripens on the fine walnut trees that are planted on the "snug little island," because the season is not long enough nor warm enough to complete the job the tree undertakes. Accepting the fact, the English growers harvest the walnuts when the shells are soft enough to thrust a knitting needle through with ease. Then the housewives pickle the fruit, husks and all, and make catsup of them. Both are fine as relishes with cold meats.

"Persian walnut" is the most accurate name for the tree we are discussing, for its native home is on the hillsides of Persia and Asia Minor. The tree in the woods bore nuts that savage men harvested in the early times, before history was written at all. This tree was among the first to be cultivated. The nuts were gathered and planted

in countries to the west. Classical literature tells of *Juglans*, "the acorn of Jove," that kings sent as presents to other kings in countries where this rich delicacy was not grown. So the nut, *Juglans regia*, "fit for kings," made its way into France, where most of the horticultural work of improvement was accomplished. Large nuts, with rich flavor and thin shells, were grown centuries ago.

The herballist and botanist, Parkinson, wrote in 1640 about a kind of "French wallnuts, which are the greatest of any, within whose shell are often put a paire of fine gloves, neatly foulded up together." He astonished his English readers further by describing another variety "whose shell is so tender that it may easily be broken between one's fingers, and the nut itself is very sweete." No wonder the English gardeners were keen to grow these "wallnuts," and grieve to this day that they cannot ripen the nuts.

Southern California raises walnuts equal to those of the south of Europe. The climate, near the coast, is mild and equable, and the air moist. Irrigation, with good drainage, and garden tillage, complete the list of the tree's requirements, and it flourishes like the biblical green bay tree. Twenty years of growth have produced trees

sixty feet in height and spread, that yield six to eight hundred pounds of nuts per tree.

Compute the market value of that crop at the retail price your grocer charges. Charge half to cost of raising the crop and getting it to the wholesaler. Then you can understand why walnut growing is an industry that is spreading rapidly into new territory.

I think it must add to a walnut farmer's satisfaction to look back along the trail that brought this tree from the wild woods of Persia to the garden-orchards of his San Fernando Valley, behind Los Angeles, and to know that it is more than ever before a tree that bears nuts "fit for kings' tables." No longer is it what the name *walnut* means, "a nut from a far country," but a home-grown product of American orchards, and cheap enough so that the people can use it as an everyday food, more wholesome and better in all ways than meat.

The wood of the English walnut is beautiful and valuable, the best in the world for gunstocks. Once there was a craze for walnut furniture in Europe that lasted until mahogany, from Central American forests, set fashion chasing after the newest thing. The wars between European nations exhausted the marketable walnut lumber,

and the threatened famine in material for gunstocks led to the passing of a law in several countries, during the seventeenth century, that before a certificate of marriage could be obtained, the young man applying must show a certificate setting forth that he had planted the required number of walnut trees. These plantations, made no doubt under protest, in many cases, brought wealth to their owners, in nuts and then lumber, in the years that followed. It is a pity that today Italy, whose walnut lumber ranked highest in quality, should not cover her bare hillsides with the same trees, and so restore the waste land to productiveness and beauty.

## HICKORIES

Two species of the hickory genus produce nuts of fine quality in the woods, and are beginning to be improved by cultivation and seed selection. They are the shagbark, or shellbark, of the northern states, and the pecan of the South. Both are handsome shade trees and produce exceptionally good lumber.

The Indians used the nuts of these trees as food, collecting stores of them for winter each autumn, despite the protests of the squirrels.

The early Virginians, imitating the patient squaws, pounded the nuts, shells, and kernels together, in a mortar, then strained out, after boiling in plenty of water, the rich "hickory milk," to which they added cornmeal, and then baked, on hot stones or in ovens, cakes fit for a king. Oil pressed from the kernels they found the equal of olive oil, a luxury seldom seen in the New World then.

The pecan is a long, pointed nut, with a much-crumpled kernel in an astringent, corky, red wrapping, under a thin, smooth shell. Improvement by selection is reducing the thickness of both coverings, increasing the size and plumpness of the kernel, and the productiveness of the tree. Though many plantations of pecans have been made, and the crop is certainly a paying one, the great bulk of the pecans are still gathered in the woods. The meats sell at sixty to seventy-five cents per pound.

### CHESTNUTS

Famous old chestnut trees, supposed to be near two thousand years old, and most picturesque in their decrepitude, are venerated in different sections of southern Europe. They divide honors with the ruins of temples built with hands. Far more attractive, to my mind, are the sturdy trees

of middle age, burdened in October with the fruit, that falls out of the prickly, opening burs, much as our own chestnuts do in late fall. They are much bigger fruit than ours, but not so sweet and rich in flavor. These chestnuts are starchy, and nutritious, furnishing a staple food comparable to the potato, though sometimes made into sweets.

The American nut is not usually cooked, but eaten raw when mature, which is about Christmas time. The shells are thin and tough, but the meats are rich in flavor and very sweet. Roasting cracks the shell and makes the nuts mealy.

The timber of chestnut trees is especially valuable for railroad ties, as the wood does not readily decay in contact with the soil. So the lumber business was vitally concerned when, a few years ago, the chestnut trees in the neighborhood of New York City mysteriously died. The swollen twigs of the smitten trees were studded with yellow pellets, or crumbs — the fruiting bodies of the fungous disease that had developed unseen under the bark. Out of these pellets the "blight" discharged the spores that were carried away, by wind, and possibly by birds, to spread the infection to healthy trees. The baffling thing is the fact that no spray of Bordeaux mixture, or other fungicide, can be applied to this deadly blight, for

it works in the dark — in the tree's vital part, the cambium, that lies hidden by the outer bark.

Much money has been spent in the effort to conquer this disease and to check its onward progress. The problem is understood, but its solution has not yet been reached, and the outlook for the future of chestnut forests is most discouraging.

Chestnut trees introduced from Japan promise us a home-grown nut equal to the best European varieties. These oriental chestnuts are large and fine in flavor when cooked. The trees are handsome, and they bear at a very early age. These traits in a hardy species assure its popularity over a large territory.

Chinquapins are small chestnuts, the fruit of a dwarf species, that grows on barren, broken ground from the Middle States south and west. The husk contains a single nut, which is sweet and rich, but rarely seen in markets, because the gathering is slow and difficult work. But pigs enjoy themselves in the woods when the chinquapins are opening their spiny little burs.

### BEECHES

The small, triangular nut that is borne in pairs in the prickly, four-parted husk of the beech tree

has small claim to the attention of the dealer in commercial nuts. But you and I know that it is sweet and rich, once you get it out of its shell. Its chief limitation is its diminutive size. In a good year, the crop will furnish the best of pasturage for fattening pigs. In the old days, the settlers counted on turning their swine into the woods to get into condition for the finest bacon and hams. This fact gives significance to a popular trademark.

Beechnuts in Europe have, from ancient times, been used as an article of human food. Beechnut oil, refined, is as sweet as olive oil. It is used as a cooking oil, and in crude form for illumination.

The botanical name of the tree, Fagus, comes from a Greek word that means, "good to eat." The foliage of beech trees, silky and beautiful as it turns to yellow in the fall, serves a number of useful purposes. In Switzerland the stable lofts are stuffed with the leaves of beech and linden, which cattle eat as winter fodder. Mattresses are stuffed with the fragrant leaves which are credited with sleep-inducing powers.

The wood of beech is one of the important hardwoods of Europe. It has the distinction of being used for the leaves of the first books made,

The word *book* goes back to the same root as *beech*. The smoothest bark in the woods was naturally chosen when tribal chiefs sent the first messages, written in crude hieroglyphics, to each other. Unfortunately the tendency to carve on beech bark persists. It is impossible to find a well-grown tree in park or near a high road that has not been scarred with jack-knife monograms, and meaningless symbols.

### OTHER NUTS OF COMMERCE

*Hazelnuts* are small and hard-shelled but delicious nuts, that grow on small bushes in the American woods, and come to market locally and in very small quantities. The clearing away of forests has exterminated them in many regions, and thereby we lose a charming shrub.

The *filbert*, or *cob nut*, is the large hazelnut of Europe. It is imported in considerable quantities but is not grown here for market.

*Brazil nuts* are grown on large trees in the forests of South America. They are rich in oil which is extracted for the use of watchmakers and artists. The port of Para ships most of the nuts to other countries, where they are eaten with relish by those who do not object to the oily, white meats. Para-nuts and "nigger-toes" are names

commonly in use. Several triangular nuts grow in a solid woody case as big as a man's head.

*Pistachio-nuts* are the seeds of a sumach tree, native to Asia Minor. The pale green kernels are enclosed in a thin, two-parted shell, which is easily opened when the nuts are dried. They are oily and have an agreeable flavor. Quantities of the nuts are consumed by the people of India. Americans use them in confectionery and for flavoring and coloring ice creams and other fancy desserts. They are also used as salted nuts.

A related sumach yields the lacquer of Japanese boxes, an unexcelled varnish, shiny and black, made from the sap of the trees. The leaves of another yield tanning material, used in making the finest of leathers. Wax is another useful product of the sap of certain sumach species.

*Cashew-nuts* are queer, kidney-shaped, or U-shaped nuts, in hard shells, each borne as a small appendage below the fleshy-colored stalk, that might be mistaken for the fruit. The trees which are large, and look like walnuts, are chiefly West Indian and tropical American species. The nuts are exported to other tropical countries, and are coming to be used now in the United States, where they are roasted in oil and salted like almonds.

Cocoanuts are described under Palms.

# Plants Whose Leaves and Stems We Eat

## CHAPTER V

### Lettuce

The wild prickly lettuce grows as a tall, ragged-looking weed along our roadsides, and springs up in fields whenever they lie fallow, or are not carefully cultivated. We call it the "compass plant," because its narrow, opposite leaves hold true to the points of the compass. The blades avoid the full force of the sun by turning edgewise to its rays. Break off a spray of the narrow-necked, daisy-like flowers, and the family name, *Compositæ*, is plain. The Latin name of the lettuce, *Lactuca*, refers to the milky juice. It has medicinal properties that soothe and sometimes induce sleep. A lettuce salad and a combination of lettuce and celery are good for tired nerves.

The wild lettuce looks over the garden fence, or the frame of the hotbed, at rows of green heads of cabbage lettuce, solid yet tender, the crumpled outer leaves covering the blanched heart — a sight the gardeners gloats over — the most popular salad plant in the world!

Thousands of years separate the wild parent plant from its domesticated offspring. But the relationship is established without a doubt. Centuries before Christ the Persian kings were served with salads made of the leaves of wild lettuces. The parent species grows in Europe and has come as an immigrant to America, but the original home was Central Asia. Let the garden lettuce stand a few days after it reaches prime condition for the table and it bolts to seed. The flowers and dandelion-like head of seeds are like those of the wild species. The leaves have been broadened and the stem shortened through the centuries of cultivation.

Most of us remember the lettuce bed in the garden, crowded with plants from seeds sown broadcast. We picked the leaves, one by one. The individual plants were not considered. The later method is to transplant the seedlings, and let each one form a head.

Three lines of development have been followed in the improvement of the wild lettuce, with the understanding that succulence of the leaves, and delicacy of flavor are striven for first of all. The first aims at a rosette of crowded, flaring leaves; the second, at a close, self-blanching head; the third at a long, moderately close head of fleshy leaves, with particularly tender midribs.

As to cultivation, three classes of lettuces have been developed: (1) Quick-growing spring varieties; (2) large, heat-resisting summer varieties; (3) hardy winter varieties.

The Boston head lettuce, with its crumpled, plain-marginned leaves, tender and rich in flavor, from the green outside to the white centre, is the favorite in this country. It is grown the year round in the open, in hotbeds, in cold frames, for home use and for city markets.

The English people, at home and in Canada, are devoted to the Cos lettuces, with the long head of spoon-shaped leaves, tender and rich in flavor, with midribs thick and white, almost like those of Swiss chard. These leaves are eaten like celery, dipped in salt, as well as in salads. Americans are learning to grow these excellent varieties.

The cool, damp climate of England is admirably adapted to lettuce culture. Many of the hundred cultivated varieties have originated in English experimental grounds. Loose, rich soil and good culture keep the plants growing rapidly, which is the main aim in the production of any leaf crop.

Since growth takes place in daylight, and the plants rest by night, experiments to test the effects of artificial light have been made. Lettuce

is one of the crops most benefited. Plants that received the light from electric arc lamps half the night are ready for market a week or two weeks sooner than the normal crop. Gardeners that make a specialty of forcing lettuce find that it pays to use the light in their houses; the quicker the heads mature, the higher their quality.

## ENDIVE

When lettuces, languishing under the summer heat, bolt to seed in the garden rows, instead of making the fine heads we expect, we must be resigned, and turn our attention to the late-sown endive for our autumn salads. So many people do not know the plant, whose thick rosette of narrow, frizzled leaves shade so beautifully from dark green to the creamy-white centre. Tied loosely at the top, for a week or ten days after it reaches full growth, the plant blanches. Blanching modifies the tang of dandelion in the leaves; as they whiten and acquire an extremely delicate flavor. No salad is prettier in the bowl than endive; and none is more wholesome as a food and tonic combined.

It was the foreigners that put endive on the benches of American greengrocer shops, and thus

taught us to eat what we cannot resist buying because it is so pretty. Europeans use it as a pot herb, and the gardeners have so far improved the varieties that it is in market the year round. There are self-blanching kinds, that head like cabbages when partly grown. A broad-leaved kind is called Escarolle.

When the blossoms appear, they are blue and closely resemble the ray-flowered chicory, a near relative, in the Composite Family.

### DANDELION

The teeth of a lion form a jagged line, just like the toothed margin of the leaf of this familiar dooryard plant, the dandelion. "Dent-de-lion" is the French name. Can you read the meaning into it?

Dandelions grow wild and rampant over the Temperate Zones of the northern and southern hemispheres, and are always invading new territory. The acrid juice has a considerable reputation in home remedies concocted by old wives, versed in herbs and simples. Dried roots of dandelion are among the druggist's stock, too. The earliest shoots have a tonic effect on the sluggish system of one who has kept indoors all winter,

Boiled as greens, these young dandelion rosettes are just what the hungry man craves and enjoys in April.

The constant demand for wild dandelion greens in the Paris markets led the gardeners to bring in the wild plants, select the best for seed, and thus to improve the species, and make of it a garden pot herb. The wild plant is stringy, and bitter in flavor compared with the crisp, half-blanched, mossy-fringed leaves of cultivated varieties. The improvement is accounted for by good culture in fertile soil. Blanched dandelion salad in early spring is like the endive that comes in fall.

### GLOBE ARTICHOKE

The French people are particularly fond of a vegetable which is the flower head of a robust plant belonging to the same family as the daisy and sunflower. All such plants bear numerous small flowers, on a flat, circular disk, surrounded and protected by green scales, called *bracts*, that overlap, in rows, concealing the flowers until opening time.

The edible parts of the globe artichoke are the tender bases of the bracts, and the succulent disk itself, after the flowers are removed. This is

done after the heads are boiled tender. The bracts are easily removed as eaten. We dip the tender white end into melted butter, and finally eating the white "bottom" with the same seasoning.

Dressed with oil and vinegar, the tender portions of boiled artichokes make a delicious salad. Many more ways of cooking and serving this high-quality vegetable will be hunted up by all who like it.

The artichokes grown so extensively for market and for home use in France can be grown here but we have not got at it yet. The plant is very lusty, even as it grows wild in Barbary and southern Europe. In the garden it grows easily to a height of three or four feet, and its handsome cut leaves are a yard or more in length. It deserves to be raised, if only as an ornamental plant.

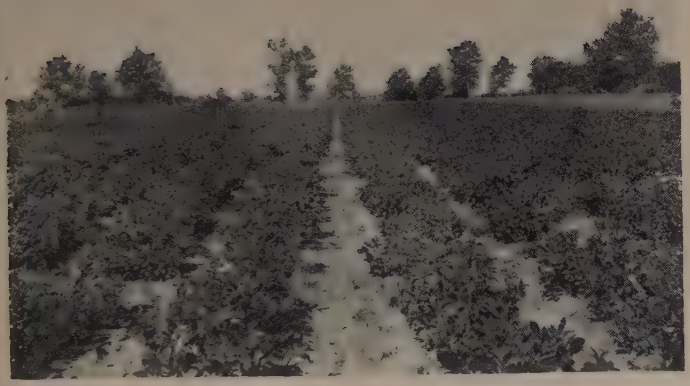
The numerous varieties of artichoke grown in the gardens of rich and poor in France are all regularly propagated by suckers rather than by seeds. These new shoots start from the main stem just underground. They are cut off, each with a bit of the old stem as a "heel." One or more suckers are left to make a new top on the old plant, which outlives its usefulness in three years.

Though it would go on bearing, the size and quality of the heads decline. Each sucker set out soon grows into a vigorous new plant with two or three years of abundant productivity before it, if the gardener does his duty.

### SPINACH

For greens there is no plant that compares in popularity and merit with spinach. It is a member of the Goosefoot Family, that produces a great many weeds in America, but no plants of any value. The gardens of Europe have produced many early, late, and midsummer varieties. In warm regions spinach grows all the year round. California gardeners need never be without it. Even in New York state, the plants will live over, if protected by a mulch, and in many places without. Thus, a crop sown in October gets a good start before winter, and is up and ready for cutting early in spring.

New Zealand spinach belongs to a different family, botanically, but from the gardeners' standpoint it is close to the other species. Its fleshy leaves are able to withstand the hottest weather, and furnish the table with a most acceptable pot herb when others fail utterly.



A thrifty peanut field in North Carolina

A single peanut plant and its nuts shaken free from dirt

The successful grower of asparagus sends it to market in attractive bundles

Common spinach is a cool weather crop, and needs moist air and soil. The summer plantings in hot climates soon run to seed, instead of producing the broad, crumpled leaves normal in all cultivated varieties.

### ASPARAGUS

Asparagus is a member of the Lily Family, as the tiny, bell-shaped flowers, and the fleshy berries declare, but the narrow leaves, and the needle-branched plant, when it reaches four feet in height, suggest any other family than the lily. I think the species, which stands alone, must have originated by the sea (or risen like Venus from the waves). You may pour brine on your asparagus bed, or scatter dry salt on the soil until the weeds lie down and die. The asparagus shoots come up refreshed and invigorated by the salt bath furnished their roots.

The edible parts of this vegetable are the fleshy shoots rising from vigorous crowns, that have been storing for some years the reserve food to produce the crop. The French gardeners have been very successful in producing choice varieties. They like best those whose stalks are thick, short, and rosy at the tip. In Holland and Belgium, a perfectly blanched stalk is the ideal. In

American gardens, green stalks, if they are tender, are counted better in flavor than the blanched ones.

The shoots are continuously cut from the uncovering of the bed in April until new peas appear in the markets, and are ready in the gardens. Then the asparagus has a chance to grow unmolested. The bed is soon covered with a dense bramble of plants that bear their seeds, and thus seed the ground under them. The full development of the leafy tops stores the roots and crowns with reserve food, which is drawn upon to make the cutting good in the asparagus season that follows the rest period of winter.

California produces a tremendous asparagus crop, that goes fresh to local markets, or is canned for shipment to eastern cities.

### SWISS CHARD

A race of beets is known to gardeners under the name *Swiss chard*. Like the ornamental beet, its root is small and tough, and the leaves are the part for which the plants are grown. Thick, tender leaf stalks branch out into the web of the leaf, and this also is tender and edible as the leaf of spinach. Some people prefer to cook stalks

and leaves together as a pot herb when less than fully grown. Some strip the stalks, boil them in convenient lengths, and serve like asparagus. Sometimes the leaf blades are boiled as a separate dish, or served cold in a salad. The stalks are white in most species.

If the roots are undisturbed, and only the outer leaves taken off, chard plants will continue indefinitely to form new leaves. When other vegetables take the place of chard, or the family tires of pot herbs, the wisest course is to keep the plants and harvest the leaves for the chickens. Little and big, they all eat the succulent food eagerly, and thrive on it as a green ration with their dry grain foods.

## CRESSES

The pungent watery juice of the cress group, and their cross-bearing flowers at time of bloom, prove that the Mustard Family embraces them all. There is a strong family likeness, especially when one nibbles first one and then another of these related plants.

The leaves of cresses are the principal edible parts, though tender stems are good, too. They are eaten as a salad or minced in soup, or merely garnish meats on the platters. "Small salads"

are made of the first or seed leaves of newly sown cress, or white mustard. Frequent sowings keep up the supply throughout the season.

Water cress is a most wholesome and delicate salad plant. It is best raised in a clear, small, running brook. Next best is the margin of a pond. Last, it grows in ordinary garden soil, if it be kept moist through good culture, and freely treated to water.

Along roadsides one often sees brooks choked with a luxuriant growth of cress. The temptation to gather a lot of it is almost irresistible. The only question is: "Is the water polluted with sewage?" Typhoid fever is certainly carried by water cress from impure streams. So we usually drive on, if we are well-informed as to the danger.

To get cresses started in our own brook we must sow the seed in a box, and as the little plants come on, transplant them into the sand where the flow is scarcely perceptible, and the water barely covers the sand. When they are established thin them by taking up and throwing into deeper water, the ones the thinning removes. They will catch root and multiply.

Another way is to buy a bunch of water cress, take out the fresh, new shoots and plant them, as we would young ones from the seedbox. It is

but a short time until they take to root and become established. Then cutting merely makes more luxurious growth, till winter stops it. Indeed, the way to keep cress from freezing is to flood the bed, so that ice roofs it. Next spring the supply will be as abundant as ever.

When old plants begin to fail they should be pulled out and a new bed started. There is nothing quite so good with roast fowls as plenty of fresh, tender cress.

Garden cress has long been in cultivation from Portugal to India. In every country it has a distinct common name. It grows as easily as weeds in the gardens of rich and poor alike. Any soil, any season, suits it. Abuse does not keep it from abundant growth. And it is as wholesome a salad, when picked in the tender stage, as one can find.

## CELERY

In its wild state, celery is a rather fleshy-rooted weed, on waste land in parts of Europe, with a top of cut leaves, and flower clusters of the umbrella type. It belongs in the same family with parsley, carrots, parsnips, and fennel. No one would think of tasting either root or leaf

stalk, for the sap is poisonous and bitter. But out of that unpromising weed has come by cultivation a vegetable that is as wholesome as it is delicate in flavor and handsome in appearance. It is universally popular with all classes of people.

Improvement in celery culture has produced self-blanching varieties, and developed from a winter vegetable varieties for all seasons. The old method of growing celery in trenches has been replaced by the easy method of growing it on the garden level, and hilling up the rows, when the time comes, to blanch the stems. From a special crop, that only market gardeners could raise successfully, celery has become a common crop, in anybody's and everybody's garden, great or small.

Nearest to the wild celery, that grows in wet ground near the sea, is the soup celery of European cottage gardens, a many-stemmed, green plant whose mild leaves lack the poisonous qualities of the wild celery, and have the nutty flavor of the blanched varieties. The leaves are cut as needed, and minced like parsley to flavor soups and salads. New leaves come on, so the plant is productive for months.

In England a red-stemmed celery is very popu-

lar. But the ideal variety in America has stalks solid, tender, and white to the leaves.

The richest moist loam, like pond muck, is the best celery soil. From the seed bed the little plants are set out, and given cultivation that keeps the soil mellow and clean, and keeps them growing. Gradually the earth is banked higher on each side of the row, till only a tuft of top leaves stick out. Now the stalks have been blanched, and the crop is ready for market. Each plant is trimmed free from its outer, rough leaves, the root shortened to a V, and the top docked.

Sometimes celery is banked between parallel boards, close to the row, and filled with earth. Rarely a celery bed is filled with earth about the plants, and a board wall placed around the whole plot. Self-blanching varieties are early, and require little help from the gardener to prepare them for market, which comes in summer time.

The principal use of celery is to be eaten raw with salt. It is served with the meat courses at dinner. Next in importance comes its use cut up in salads usually with nuts, fruits or other vegetables. More rarely it is boiled as a vegetable, and dressed with butter or a cream sauce.

It is much used as a seasoning for soups and stews. The roots are good for this purpose, and eaten raw are more nutty and sweet than the leaves. So they should never be discarded. Celery seeds are very good in salads and for seasoning. They are sold by grocers for this purpose. They are so light and small that it takes about 50,000 of them to weigh an ounce.

*Celeriac*, or turnip-rooted celery, is a variety that is useful as a root vegetable and as seasoning, when sliced or grated into soups. The stems of this variety are tough and hollow and short. Development has gone in quite a different direction from that which produced the white, succulent stalks of the ordinary celery on our tables. Celeriac is not so commonly raised in our gardens as it deserves. Those who grow it say that it is easy of culture. It adds to the winter store in the root cellar another wholesome vegetable.

Celery has valuable medicinal properties, that act favorably upon the general system of those who eat it freely. Its value is recognized by makers of patent medicines. But sensible people will prefer to take their celery as it comes to the table, from the garden, rather than in liquid form, out of a bottle.

## PARSLEY

Wherever we go, the parsley plant is there to welcome us, as we sit down, hungry as a bear, to a good, square meal. The soup and the fish are seasoned with a sprinkle of minced parsley. Its curly leaves garnish the steak or the omelette, and the salad is seasoned and adorned by the same fern-like leaves. And we do not tire of it, morning, noon, and night. It is known to everybody and it has real food value; it is not merely an accessory to the essential foods.

It is a pity that parsley is not grown in every garden for we need more green food than most of us eat, and the commonest dishes are improved by it. The reason may be that people get discouraged waiting for the seeds to sprout, or forget where they were planted. It takes a month to six weeks for the little plants to show themselves and they are feeble until they have attained some size. If the soil is kept loose and free from weeds, a few plants will soon furnish all the parsley the cook can ask, and the bed will be a beautiful green pillow until frost comes.

The fore-handed gardener pots some little plants, and when winter comes has parsley to

brighten the kitchen windows and to furnish leaves for cutting throughout the cold weather.

Sardinia is the original home of wild parsley, but to-day it grows in most European countries, run wild from gardens, and gone back to the plain leaves that mark the parent form. Selection for more ornamental leaves has developed the double-curled varieties with leaves, marvellously fluted and frayed and multiplied in their subdivisions.

In sharp contrast with the wiry-rooted, bushy-topped varieties, is the turnip-rooted parsley, with almost no leaves at all. The fleshy roots are cut up and used as a vegetable, or as soup flavoring. This plant is like celeriac, the flesh-rooted celery, in flavor and use.

### SEA-KALE

A robust member of the Mustard Family grows on the west coasts of Europe, right down on the dunes, to the line the tide reaches. In other countries it is considered a weed, but along the English Channel the people who live near the beach claim the sea-kale that grows in front of their ground. When the cold weather comes and the tops die down, the natives go out with shovels and heap sand and gravel a foot deep or more

on the stumps. This keeps the kale from being trampled, and when the new shoots spring up in March, it keeps them from turning green. For three weeks or more the harvest of the sea-kale is sent to city markets, where the long, fleshy and perfectly blanched stalks supply a delicately flavored vegetable, at a season when fresh vegetables are scarce.

Copying the methods of the shore people of Hampshire, gardeners grow sea-kale from seed and from root cuttings, and year after year cover the tops and cut the blanched leaves as they reach proper size. The bitter of green mustard leaves is dissipated by the bleaching, and the broad leaf stalks, with just a hint of the blades starting, are delicious when boiled until tender and served as asparagus is. The flavor of hazelnuts is very marked. Americans who taste this vegetable, properly cooked, wish to grow it at home. The same culture as that given rhubarb is right. It is easy of culture where rhubarb will grow. The plants live several years.

### FENNEL

A bitter-sweet aromatic odor and flavor are strong in the fennel group of the umbrella-flowered family, which includes parnsips and car-

rots, and a dozen more garden vegetables familiar to us all. The peculiar odor is found in the oil that pervades all parts of the plant, particularly the seeds, which are used in making liqueurs, and in certain medicines.

Cultivated fennels are not far removed from their wild ancestors, which range as robust weeds over southern Europe and parts of England, and run wild from gardens in places, in this country and abroad. For centuries fennels have been used but they have not been long under cultivation. The wild plants furnished the supply needed.

The common fennel grows four feet high. Its leaves are boiled and served with different kinds of fish, or minced raw to season a sauce for salmon or mackerel. This species is grown in gardens.

The Florence fennel has at base a bulk-like enlargment, due to the swollen condition of the bases of the leaves. The tops of the plant and the root are cut off, and the blanched leaves boiled till tender. They taste like celery. Often they are eaten raw.

Naples has a famous fennel that grows nowhere else. The fleshy flower stalks, enclosed in the broad leaf bases, are served raw, under the name, "Carosella." This delicacy is to be had

all the year, thanks to the pride and skill of the Neapolitan market gardeners.

The fennel of India is used as medicine and for seasoning some curries. A South African fennel yields a thick, aromatic, edible root.

The giant fennel of southern Europe is so rank that nothing but buffaloes of Apulia can eat it. The pith is used for tinder in Sicily.

### CHERVIL

The "fine herbs" of the French cooks is a seasoning mixture of leaves, chiefly of the plant called chervil. It is a biennial of the fennel, carrot and parsnip family, its flowers borne in the umbrella-like clusters that are the recognition sign for this family.

Six weeks after the seeds are sown the gardener may begin to cut the aromatic leaves. Some varieties are fringe-leaved, and these are favorite kinds, used to garnish other dishes, and themselves in salads. Turnip-rooted varieties are grown as a winter root vegetable. The meaning of "chervil" is "joy-leaf."

### DILL

Dill pickles make us acquainted with a rather rare flavor used by German and Italian cooks as

seasoning in preserves and pickles. It strikes the American palate as a blend of fennel and mint. The seeds and sometimes the thread-like leaves of the tall, wild parsnip-like plant are used. The umbrella cluster of flowers and seeds assign the dill to the same family as the fennel. In gardens it grows easily, even if in a colder climate than its native range, southern Europe, if given a warm situation, and well-drained soil.

### THE WILD CABBAGE AND ITS CHILDREN

Outside of the pretty coast villages that look out on the English Channel, beyond the thrifty fields and market gardens, lie stretches of land so rocky and uneven that it is unfit for cultivation. Tufts of weedy growth soften the bleakness of these desert places. Among the native plants that get a living from the scant soil is the wild cabbage, a lusty weed that attracted the attention of our savage forefathers, thousands of years ago, because its leaves were (and are to-day) succulent and pungent to the taste. So the leaves are in the big mustard family, to which all cabbages and their kindred plants belong.

All the way from the British Isles to Siberia the wild cabbage may be seen on untilled land,

usually as a small plant on a spindling stem, its blue-green, fleshy leaves spreading in a flat rosette or closing at the top to form a loose ball. In soil of greater depth the stem lifts its head higher, year by year, and strengthens itself by woody fibres, the side shoots, short and of softer texture, bearing the leaves. Stems three feet high may be found in favorable locations on the Irish and English coasts but on the Channel Islands a wild cabbage might be mistaken for a tree of some sort. Darwin saw on the island of Jersey a cabbage stalk sixteen feet high! He said that twelve feet in height was often attained by these plants, whose woody stalks were used for rafters by island builders. Much smaller plants have stems three or four inches in diameter. Walking sticks are made of still smaller ones.

A spike of yellow flowers crowns the top of the wild cabbage plant, just like the flowers borne by garden cabbages to-day. Leave a solid head in the row after the crop is cut for market, and what happens? The head bursts open; the stem, hidden by overlapping leaves, keeps on growing. It forces its way out of prison, runs up a foot or two, and opens its yellow flowers, that fade and are followed by pods full of seeds. Again we see the relationship of this vegetable to the mustards.

The pods and seeds look and taste like those of all mustard plants.

We can imagine how the savage hunter, returning to his cave at evening, nibbled a fleshy leaf of wild cabbage to quench his thirst. The pungent, watery juice was not unpleasant to the taste, and the inner leaves of the end rosette were tender and almost white. When the sons of those wild hunters went with their fathers they learned the berries and other wild fruits good to eat, and knew how to pick out the largest, tenderest heads of the wild cabbage plants. The next step may have come centuries later — a kind of gardening. I can fancy the women of the cave-dwellers gathering little cabbages for food, and two neighbors claiming a particularly good patch of the plants, and fighting over it. The next step was to throw up some sort of wall around it, to help the selfish victor to defend his claim. Then we can believe that, while the men were off and the women on watch, the best plants were favored by a little digging of the hard earth around their roots, and maybe watered, if they suffered for a drink. Step by step, slow as the passing of the centuries, came the saving of seed of plants with the biggest, tender heads, and weeding and tending of the young cabbages with primitive tools. The best plants helped to

Who says the Savoy cabbage is a commonplace vegetable?

Cauliflower is the most delicate vegetable in the plebeian cabbage family

We ought to know kohlrabi, the turniplike vegetable, related to the cabbages

be better, and their seed planted for the new crop: this is the way the wild cabbage became domesticated, and improved, until men demanded the garden varieties, and the parent forms ceases to be used.

Every vegetable, every fruit, that now grows in gardens and orchards as a cultivated variety, sprang from a wild species. In many cases, like the cabbage, the parent plant is growing to-day in its original state, in some country. The large number of varieties is a sign of the great antiquity of the species.

Some wild cabbage plants showed a tendency to form little heads at the axils of their leaves. They were encouraged by the grower. Seeds of the best plants were sown. The new plants had better axillary buds. Gradually the terminal shoot ceased to head. The result was the *Brussels sprouts*, one of the most delicate of all cabbage forms.

In some wild plants the tendency to form fleshy subdivisions of flower stems was noticed. Selection of the best specimens for seed producers finally resulted in a race of cabbages whose flowers are borne on a white, coral-like mass of stem branches. These form a delicious dish when cut before the flowers appear. This race of cabbages is known as *cauliflower*.

Let me tell you something interesting about cauliflower. When the fleshy flower stems of certain wild cabbage plants were first noticed, and thought to be worth developing by selection, it was the gardeners of Italy that carried the work forward until the older varieties of what we call cauliflower were produced. They called it *Broccoli*, and that is the Italian name for cauliflower to-day. All along the shores of the Mediterranean, and all through the year, these plants, in many varieties, are grown for the markets. It is not usual to hear the name, Broccoli, in other countries, though the name, cauliflower, is everywhere. It is used by itself, as a vegetable and combined with other vegetables in pickles.

The headed cabbages form a great group that developed along the line of improvement of the terminal head. The sun tinged some to a rosy color. From that the line of purple cabbages came. The solid globular head of great size is one type. The oval head, more loose and soft, is another. Late and early varieties are numerous. So are tender and hardy kinds. Heavy coarse-fibred kinds are grown for cattle. There are varieties for sauerkraut and others for crisp salads. They all fall into two groups, based upon the leaves. They may be *smooth* or *crinkled*. The

latter have the network of veins so swollen that the heads are not solid, like the smooth sort, and the leaves are far more tender. "*Savoy cabbage*," as this group of crimped-leaved varieties are called, have sweeter, milder flavor than the smooth-leaved varieties.

Swelling of the stem was noted as a character in some wild cabbage plants, and when thus distorted the stems were tender and edible. Gradually this trait has been emphasized until a race of turnip-like plants resulted. The leaves grow out of the top and sides of a fleshy globe that sits on top of the ground. This is *Kohl-rabi*. Another race sprung from plants that had their roots enlarged. The *Swedish turnip*, or *rutabaga*, has its leaves clustered at the top of a thick "root-stem," that sits half buried in the ground. The flesh is tender, but becomes stringy when left too long in the ground. The flesh is yellow. The other turnip-rooted cabbages are white.

Suppose a wild cabbage had no tendency to form heads or turnips, but responded to cultivation by producing more and better spreading green leaves. Such a plant was the parent of the kale, a tree of green, intricately curled, succulent leaves, used as a pot herb. We Americans use

kale for "greens," which means the same thing, exactly.

Another name for this palm-tree cabbage is *Borecole*. In Europe, large kinds are grown to feed to cattle. In our southern states a kale is grown that bunches its upper leaves in a loose rosette at the top, while the rest are distributed about the elongated stem. These lower ones are cut for greens as they reach good size, but are still tender. At the end of a summer the plants stand as bare stalks, each crowned by the small rosette around the growing point. This is the *Georgia collard*, the only cabbage that thrives in a warm climate.

The *Chinese cabbage*, or *Pe-tsai*, is a distinct species, no closer to the wild cabbage of Europe than the plum is to the cherry. Its curly leaves have white, fleshy stalks, that do not form a close head. They are more like Swiss chard in appearance, but the flowers prove it a cabbage. *Pak-choi*, another variety, is taller, with whiter stalks. Both are tender and of delicate flavor if cut when young and boiled like kale. The ribs alone may be served like asparagus. In American gardens, these Old-World vegetables are a delightful surprise, easily raised, and a valuable addition to our list of food plants.

No vegetable responds more quickly to good treatment than the children of the wild cabbage. Rich soil, moist and fine and free from weeds, produces the finest specimen plants. Quick growth, uninterrupted by drought or neglect of other sort, makes the biggest, tenderest leaves and stalks, and they have the most delicate flavor. The cool, moist climate of England makes it the best place in the world to grow the whole cabbage group.

If the gardener neglects his cabbages they grow tough and rank in taste, do not head solidly, and finally burst open and "bolt to seed." Plant the seeds of such neglected heads, and do not tend them. The next crop is uglier than the last. Save seed of these plants to sow, and let alone. In a few generations what are our cabbages like? They have gone back to the old wild cabbage form of the British coast. The gardener says: "These plants revert to the original wild type."

Just so your kohl-rabi and turnip-rooted cabbages will lose the plumpness and tenderness and delicacy of flavor, unless fed and tended. So will the cauliflowers and the kales, proving that their ancestors were the same as those of the headed cabbages, which alone keep the family name.

## THE ONION FAMILY

The onion is a native of Western and Central Asia, from which territory it came into cultivation, and spread, in various forms, through Europe, and eastward to China. In America, Gray described six native species of wild onion, and one species brought from Europe. Dairymen dread the appearance of these weeds in pasture land, for if cows crop the stringy leaves, milk and butter are tainted with the peculiar onion flavor. What looks like a patch of tender grass in open woods in early spring often turns out to be wild onion. Once established, the colony is hard to keep from spreading in gardens and fields.

Improvement in this species has made the bulb bigger, more tender and more delicate in flavor. A "scullion" is an onion whose bulb is small, and stem thick, an individual that reverts to the early wild type. Nobody wants it, if he can get a fat onion with a slim neck.

The biggest onions, often a pound in weight or more, grown in Mediterranean countries, are the mild, white Spanish variety. The Island of Bermuda grows the mild Bermuda varieties, almost the equal of the Spanish in delicacy and

sweetness. California grows both kinds in the Imperial Valley.

The "potato onion" is a form that substitutes for the single bulb a number of irregular and smaller bulbs. No flowers, seeds nor "sets" are formed. The compound bulb is separated into its divisions, each of which, if planted, produces a cluster. These onions are fine in flavor, but not so convenient to prepare as the single, large ones.

*Shallots* are onions of the compound bulb group, a different species, however, from the common onion, which we know in so many varieties. From early times this vegetable has been used for seasoning, its flavor being more delicate than any old-fashioned varieties of onions. The bulbs keep the year round.

*Garlic* is another many-bulbed onion, native to southern Europe, and much esteemed there as a flavor, copiously added to stews and other dishes. When grown in northern gardens it is stronger and more burning than in Italy. So a rub of the salad bowl with the fresh-cut surface of a single "clove" (little bulb) of garlic is usually quite enough of this pungent flavor to suit our taste.

When fully grown, the garlic is pulled, and the dried stalks braided together, this long rope

loaded with the bulbs is displayed in grocers' doorways.

*Chives* are tiny onions that grow tufted together by the interlacing of their fine roots, the narrow leaves, like grass blades, making the clump look like a patch of fresh, green turf. The bulbs are about the size of grains of corn. The part we eat is the leaf, which is a delicate seasoning for soups and salads. The usual plan is to buy a pot of chives at the greengrocer's, and keep it to shear as needed. The cutting off of the tops induces a thick growth of more, and the pot lasts indefinitely.

Outdoors, chives make a pretty border planting for any flower bed. The tuft may be separated, and the single bulbs set. Each soon makes a cluster of new bulbs, and the top spreads.

*Leeks* are onions whose leaf-bases form long cylinders of white, tender flesh, rather than globular bulbs. The parts are blanched and delicate in flavor. Like other onions, they are boiled, as a rule, and often served with a cream sauce.

Distinct as are these species of Allium, yet they are joined by intermediate forms that puzzle the botanists to name them. The devotee of the onion merely counts them all on his ten fingers,

and is glad that there is not one less, for among the cultivated vegetables there is not another tribe of more wholesome foods than these.

The seed of the onion has, within its outer coat, a mass of starch, enclosing the bent embryo, shaped like a pencil. The tip pushes out of the shell, after the moisture and warmth in the soil start it to growing. From a certain point in the tiny shoot the growth is made in opposite directions. Downward goes the root: upward goes the stem. But this is the end attached to the seed, and that is lodged in the warm earth. The seed is not lifted out of the ground, as peas and beans are. Instead, the growing stem of the onion forms a loop which comes out of the soil looking like a very white hairpin, sticking straight up! Out of the bend there comes a leaf that rises from the place where the root struck off toward China. By the time this leaf is ready to do its duty, the seed has withered, and its connection with the hump of the stem dwindles to a thread. This attenuated whip-lash breaks, and the stem straightens, and one by one, other leaves form.

The peculiarity of onion leaves is that they are narrowly tubular above ground, and fleshy and spreading, colorless, and still tubular just below ground, and above the bunch of fibrous roots.

The effect of such growth is to make a bulb-like vegetable out of the concentric leaf bases. Count the leaves and you know how many layers there are in the onion.

One season's growth is needed to lay up store of food in bulbs. So the onion rests over winter, and if left where it grew, starts on its second spring to use the store of fleshy leaf-bases to feed one or more flower stalks which rise higher than any leaves of the former season. These stalks are hollow, green and swollen, but tapering to the dense rounded cluster of lavender, or white flowers. These are followed by seeds. After the seeds ripen, the bulb is withered, the plant dead.

Sometimes little fleshy bulbs appear instead of flowers. These are constant in some varieties, occasional in others. These are called "onion sets." The flowers have been transformed into bulblets from which full-grown onions grow the following season.

### RHUBARB OR PIE-PLANT

The druggist sells a bitter tonic extracted from the rootstocks of a wild plant called rhubarb, that grows in Thibet and northwestern China. The acid of the sorrels is in the whole plant, which

has come into cultivation for its fleshy leaf stalks which are eaten in the spring.

Heart-shaped leaves a foot or more across the blades, stalks two inches in diameter, and more than a foot long, are common enough in kitchen gardens, in England and the United States. The wild plant would probably be very disappointing in the rôle of "pie-plant." It has taken many years of cultivation and selection to get the huge stalks, thin-skinned, free from coarse fibres, rich in flavor and color. Only the richest, finest, and deepest soil produces such choice quality.

Special demand for rhubarb comes in early spring. The growers keep up the cutting of the leaves until the early berries come to market, and people are tired of pie-plant pie, and turn gladly to strawberry short-cake. With the approach of hot weather the stalks become more corky and lose flavor.

The earliest pie-plant is raised by the gardener who protects the crown, and stimulates growth by spreading stable litter, or other heating, fermenting fertilizer, about the plant. A half barrel set over the plant is an admirable plan for the small garden. This covered wind guard conserves heat, and moisture, and the darkness makes the leaves

stretch up for light. These conditions produce long, blanched, tender stalks.

After the rosette of leaves is fully developed the rhubarb plant sends up a jointed stalk crowned with a series of axillary flower clusters, that proclaim the plant's relationship with buckwheat, sorrels, docks, and smartweed.

The way to make new plants is to divide the crown and roots. About four years is as long as one plant should be allowed to grow. After this the crowding of the roots makes inferior leaves.

# Plants Whose Roots and Tubers We Eat

## CHAPTER VI

### The Garden Beet and Its Kin

Have you ever gone out into your garden and pulled a good panful of little beets, to thin the crowding globular roots, and incidentally to have for dinner a dish of beets, boiled, tops and all, and dressed with a little vinegar to temper their sweetness? Or have you bought from market, or from your favorite vegetable man at the back door, red beets, none bigger than a hen's egg, smooth, fine-grained in flesh, that came to the table sliced and sizzling in their ruddy juice, seasoned with salt, pepper, sugar, and butter? Another thrill of the same sort comes when mother opens, as a special treat, a can of those tender little beets she put away in spiced vinegar. Can you name a vegetable that matches young beets in delicacy of flavor, or in beauty of color when served on the table?

All the year round beets are to be had in market, for they are kept in root cellars all winter, and there are spring, summer, and fall varieties that

any one with a garden can raise for himself. Some are red, some white, some banded red and white, when cut across. Some are yellow, some banded yellow and red.

To avoid the stringiness that one sometimes finds in beets, the gardener plants his seed in rich, deep soil, and keeps his plants growing rapidly. By weeding and hoeing, he keeps the soil in good condition, and saves the moisture in it. Watering is necessary in dry weather. Then he must not forget to thin them as the plants become crowded, and to pull them when they are in the best condition — not to leave them past their tender stage.

The common ways of cooking beets are boiling and baking. More commonly we boil them for later use in salads, and pickled. Baked beets have a deeper color, and firmer texture than boiled ones. In no case should the skin be broken. The stubs of the leaves should be left on, the beets scrubbed with a brush and rinsed. Then no loss of sugar, flavor or color will be suffered in cooking, and skin and leaf stubs will slip off easily before the slicing.

Besides the garden beets, a race of coarse-fleshed but very nutritious beets, called *mangel-wurzels*, are grown as a field crop to feed to stock. They

A line of samples from a schoolboy's home garden

Corn, parsley, carrots, wax and lima beans, cucumbers and tomatoes

have very large leaves, and the roots often rise partly out of the ground.

One race of beets has been developed as ornamental plants, the *foliage beets*, used in Europe for carpet bedding and borders of flower gardens. The ribs and veins of the leaves are high-colored, and the varieties differ in form and coloring.

Even the garden beets are second in importance to the *sugar beets*, a race that furnishes the sugar grown in temperate climates.

Sugar beets are usually small varieties, with small tops, the flesh white or yellow. The tapering root goes deep and drinks in the soil moisture, which is the raw material out of which the leaves manufacture the sugar. That is stored away in the fleshy root, and later extracted by machinery.

To understand how the beet was made a sugar-producing plant we must know its way of making seed. It is biennial. That means it takes two years to complete its growth. The first year is consumed in producing a leafy top and a fleshy root. Then the top dies and the plant rests. Next spring the top sends up a flower stem, and the flesh of the root is absorbed by the flowers and seed pod as they form. When the seeds are ripe the root and stem are withered and dead. They have done their work. Each wrinkled seed case,

the size of a pea, contains several small, brown, kidney-shaped seeds. We mistake the pod for a seed, unless we open one and explore it.

The wild parent of all the beets is a weed that grows on the coasts of the Mediterranean Sea, and also on the Canary Islands, and inland in Eurasia as far as Persia and Babylon. It is found in muddy shore soil in England and parts of Scotland and Ireland.

We know that the wild beet has been in process of cultivation a little over two thousand years. This makes the family line of these vegetables very short compared with that of cabbages, which have been grown from ancient times, possibly six thousand years.

### RADISHES

A familiar and very popular member of the Mustard Family is the radish, grown wherever we see a garden as large as a handkerchief. One of the quickest seeds to sprout, and the earliest vegetable ready for the table is this radish, grown in many varieties, to suit different climates, seasons, and personal preferences. All come from a wild ancestor, probably native to Europe, though that matter is in doubt. The cultivated forms some-

times escape from gardens, and give the farmer trouble enough as a flourishing weed. When this happens, the plants make more head than root, and "go back" to their ancestral form.

The early spring radishes are little, and mature quickly. In salads, the leaves are often used, as well as the fleshy root, when the earliest crop comes on. Red or white, globular, olive-shaped or long, the early radishes are known in many varieties.

Summer radishes, varieties that best withstand the heat and drought, and winter radishes, big and solid, that take months to grow, furnish valuable food supply throughout the year. Winter varieties keep without sprouting or becoming hollow or withered until time for the early spring crop.

Radishes from China and Japan have been introduced. They are very large, but tender and mild, and very easy to grow.

The seed pods of radishes, gathered when still crisp and tender, are a fine addition to home-made mixed pickles. The half-formed seeds are embedded in the pulp of the pod; seeds and all have the flavor of mustard, without any of the strong, bitter taste, or stringy fibre that is later found.

We have learned the use of the pods from European gardeners who grow one stringy-rooted spe-

cies, the rat-tailed radish, exclusively for its succulent, twisted, pencil-like pods, often a foot long. These are eaten raw when fresh, or pickled for winter. Warm countries of the Old World use radish pods very commonly. We are just learning to do so.

### HORSE RADISH

The white, fibrous root of the horse radish is grated, seasoned with salt and sugar in vinegar, and served as a condiment, with meats, especially roast beef. It is used also for sauces served with fish and meats.

The plant is a root vegetable, growing wild in Europe, and much improved in size and quality by garden culture. As it is a perennial, some people let it occupy a corner, uncultivated and undisturbed, year after year. When they go to the bed and dig roots in spring, they complain because of the crooked, stringy ones they find. To get good, straight ones, care is needed.

Rich, deep soil, in mellow condition is planted with root cuttings of the plant, laid horizontally or slanting toward the noonday sun, not more than two inches below the surface of the soil. They should be set in rows a foot or more apart, and three feet between the rows, for best culture,

and best specimens. After a whole season of growth, roots may be dug that are fine in quality and form. Better leave them till they have made a second season's growth.

The name, *radish*, comes from the Latin, *radix*, meaning root. *Horse*, as prefixed to plant names, means coarse, big, unfit for human food, though possibly relished by horses. Any one who has tried to eat fresh horse radish knows that "a very little of it goes a great way!" Grating the cleaned roots is a tearful occupation, much like peeling onions. The reason that the prepared horse radish one buys is so mild is that it is adulterated copiously with grated turnip, a poor relation that costs less than the genuine, and is harmless, though a cheat when so used. If one does not raise the plants, it is best to buy the roots and do the grating at home.

### TURNIPS

If they had been turned at a lathe they would scarcely be more smooth and evenly rounded — the turnips we see harvested in the fall for market, or to be stored for winter use. The name, *turnip*, means "turned." They are flattened, or long and tapering, or globular, but all are round. They would roll over and over, in one direction.

Turnips are first cousins to the cabbages, as the flowers and seeds plainly show. The flavor, too, calls attention to the kinship. Wild turnips were cultivated thousands of years ago to make their roots larger and more tender. The different shapes were later in being developed. White and yellow turnips are the two colors grown. This refers only to the flesh. The skin may be of these colors, or red, gray, or black. Varieties grown for human food are sweet and tender, if they are not checked in growth by drought or lack of tilling. Field turnips, raised for cattle, are usually coarser, not so well-flavored, nor so tender. But all have a higher food value than potatoes, because they have less starch and more flesh-forming elements.

The turnip is not a fleshy root, like the sweet potato, nor a fleshy stem, like kohlrabi, but a combination of root and stem. Notice the clustered leaves at the top. They are attached to the shortened stem of the plant, which is called the "crown." This stands at the surface of the ground and performs all the stem duties, the part below ground doing duty as the root of the plant.

The English farmer sets more store by his turnip crop than the American farmer, and it is rather hard to understand why. The Cornell Experiment Station raised 25 tons an acre of cattle

turnips in 1904. The soil was a good loam, well cultivated. This crop was harvested four months after the seed was sown, and the ground was clear for another crop. This is certainly a satisfactory return for the investment of money, time, and labor.

Often farmers prefer to leave the turnips in the ground for stock to crop through the open, mild winter, or even to dig through snow. The wholesome green food is so craved by cattle toward spring. Sheep are especially fond of turnips, and they like to dig for them, too.

In digging turnips to store for the winter, farmers have the leafy tops chopped off before the roots are buried in sand or boxed in the airy root cellar. Delicious "turnip salad" is made of the tender sprouting tops of stored roots, late in winter. Young turnips are also used, tops and all, as a pot herb.

Nobody knows when the wild turnip came into cultivation. But we do know that the Spanish explorers brought them across the sea and established them in Mexico in 1586. They came, too, with the earliest settlers of New England and Virginia. Some early observer wrote that the Jamestown colony raised better turnips than were raised in England, whose gray skies and moist,

cool atmosphere are especially adapted to this crop.

There is not much better treatment of the patient British soil, that has borne crops continuously for hundreds of years than the "Norfolk rotation," by which turnips, barley, clover, and wheat are the crops that follow each other in order. The crop that most robs the soil, wheat, is preceded by clover, the crop that takes nitrogen from the air, and gives it back to the soil.

### CHICORY

A ragged, sprawling weed has caught the eyes of every boy or girl who tramps along country roads, for it opens its blue flowers early in the morning, and closes them about noon. The result is that the plant is lovely in the morning, and ugly the rest of the day.

This chicory, or succory, is called "wild bachelor's button." It is scattered as a wild plant over Europe and America, in many places escaped from cultivation. It belongs to the Composite Family with the dandelions and the lettuces and the sunflowers. Its bitter juice has medicinal properties. In many communities it still is the standard home remedy for jaundice and other liver complaints.

We do not hear of chicory as a commercial crop

in this country, but we shall in time. In Europe it is grown extensively for the roots. These fleshy tubers are used as a substitute, or adulterant, for coffee.

The roots are cleaned by washing, then trimmed, sliced and dried in kilns, roasted until dark brown, and then ground. This prepares it for mixing with ground coffee. As chicory costs one fifth as much as coffee, the more there is added to the latter, the greater the profit. Calling the mixture *coffee* constitutes a deception, of course, even though the more chicory used, the better some people like the drink. Indeed, chicory is sometimes used alone as a beverage. It has a bitter, aromatic flavor, and considerable more body and color than an equal amount of ground coffee.

If you are prejudiced against chicory, and suspect adulteration of your coffee, nothing is easier than to detect the fraud. Pour a teaspoonful of the ground "coffee" into a tumbler of water. Stir it. In a short time the chicory will become softened, color the water, and sink to the bottom. The coffee will remain hard, and float on the surface for a long time.

Since the public demands chicory, and we know it lacks the harmful properties of coffee, it is a crop no one needs be ashamed to raise. It is a staple

product of farms in many agricultural sections of Europe, and recently is becoming established on a profitable basis in this country. A factory is always the centre of a chicory-growing community.

The farmer who grows chicory near a factory can get about $7 a ton for the crop. The average yield is ten tons to the acre. Allowing half of the gross returns for cost, which is enough, he has a profit of $30 per acre clear. This estimate, based upon averages carefully made from actual experiments by farmers, should encourage timid folk to embark in the new enterprise, if opportunity comes their way.

Certain turnip-rooted varieties of chicory are grown as a table vegetable, to be baked or boiled like turnips. Another group of varieties developed from wild chicory have succulent stalks and tender, finely cut leaves, used for salads. One must like the tang of young dandelion leaves to enjoy chicory as a salad or a pot herb. Boiled and served with vinegar and other seasoning, it is delightful in early spring. The turnip-rooted varieties are used for producing winter salads. "Barbe de Capucin," and "Witloof," are two chicory salads one finds all winter in any good market in American cities. We have recently

learned from our foreign neighbors to appreciate these two new things. The methods the gardeners use to get them are interesting, and also very simple.

Any plant which grows a turnip-like root expects to use the food stored up in this fleshy portion to send up a flower stalk next season, and mature a crop of seeds. See how the gardener thwarts the chicory's plan for perpetuating its race. He wants leaves, not seeds. So he begins in summer, when the tops are flourishing and the roots swelling. He cuts off the top, a little above the ground. The root hastens to send up a stock of small leaves to do the work of those that are gone. In autumn the largest leaves are again docked, the roots shortened, and the plants taken up, and set close together in boxes of rich soil. When frost comes, watering ceases, and the boxes are covered. As needed they are taken into a dark, warm cellar where each root is able in a short time to produce a head of crisp, blanched leaves. These are the barbe de Capucin salads, the particular delight of the French. Each root will produce two crops of leaves six inches long.

"Witloof," the favorite winter salad of the Belgians, is grown in a different way. The roots

are buried in trenches filled with layers of manure. Each one produces a long head of leaves that consist largely of blanched blades, with just a frill of webbing near the top. A second crop follows the first cutting. If the roots are brought out of the trenches, and kept in the dark, warm cellar, the second head resembles barbe de Capucin.

American gardeners have acquired the knack of growing these salads, and Americans are learning to like both of them.

### SALSIFY

One of the root vegetables that keeps company with the parsnip by staying in the ground all winter, and being none the worse for the freezing it gets, is salsify, called from its flavor, the vegetable oyster plant. The crown above the slender roots bears a bunch of narrow leaves, like blades of coarse grass. The English housewife takes the tender, inner leaves and uses them for salads. We use only the fleshy roots, first scraping off the thin, grayish skin, then boiling them, sliced, with seasoning of butter, pepper, and salt. We add, perhaps, a dash of onion juice, for an extra flavor. Although salsify is not grown by the average gardener in this country, it is found in any good

market, and those who are acquainted with it consider it one of the most delicate and wholesome of winter root vegetables.

The salsify plant surprises us by starting growth early in the second spring, and sending up a flower stalk two or three feet high. This stalk is crowned with a loose head of purple flowers, like daisies or little asters, followed by numerous seeds, winged for flight.

The wild salsify still grows in meadows and pastures along the Mediterranean. A yellow-flowered species, native to parts of Asia, is sometimes seen in gardens. The seeds blow away from cultivated plants and come up in neglected land. These plants have stunted roots not much better than those of wild ones. The fact that salsify "goes back" so quickly to the wild form, when it escapes from gardens, is a sign that it has not long been in cultivation.

In warm countries salsify does poorly, and may become a serious pest if allowed to scatter its seeds broadcast. In colder countries it does best. The gray, damp climate of England exactly suits it, and the English gardeners grow it to perfection. There is little freezing weather there, so it is easy to dig the roots from the soil as they are needed to cook. They are best buried in sand in root cellars,

if the ground freezes hard as it does in our northern states.

### JERUSALEM ARTICHOKE

The American Indians learned — who knows how long ago? — that a certain wild sunflower produces rootstocks like those of the dahlia, and the sweet potato, underground. The interesting thing about these tubers is that, roasted or boiled, they are good to eat. When the white men came they learned from friendly Indians to dig up the nourishing wild roots and cook them as they did potatoes. I do not know when or where the plant came to be called the "Jerusalem artichoke." It is not very close, botanically speaking, to the globe artichoke, and the edible parts of the two plants set them still farther apart than do their composite flowers.

It seems a pity that we Americans take so little pains to get acquainted with vegetables that are not as familiar already as beans. We have no patience to like a new kind with a strange flavor. We compare this artichoke with the potato, and declare it inferior. So it may be, but why compare it with that highly improved species?

The French cook will roast or boil these

tubers, or make a salad of fine quality, and different from all others. If you persevere, you will come to enjoy the new flavor, and your table has gained a wholesome and distinct vegetable.

The Jerusalem artichoke is used to taking care of itself. It thrives on gravelly soil, too dry for other crops, and in shady places. The quality of tubers produced under such conditions is not the best. Good tillage in mellow soil wonderfully improves the quality and quantity of the crop. Quick growth produces sweeter, tenderer tubers. We should judge the vegetable by its best samples. It is more productive, more easily grown and more easily harvested than the potato crop.

Almost any farm has some land on it not good for much but these artichokes. Turn the pigs into the patch and they root out and fatten on the roots. They are excellent green food for other stock in winter. Chickens thrive on them, ground fine and mixed with their grain. The tubers are not harmed by leaving them in the ground all winter.

The new crop is raised by planting cuttings of tubers, each with an eye, just as we do with potatoes, when spring comes again.

## PARSNIPS

The wild parent of garden parsnips has a long, slim root that tapers above ground into a long, leaf-bearing neck. It is one of the oldest root vegetables to be cultivated. Various writings of ancient times make frequent mention of the plant and its uses. The improvement of the species was in the size and succulence of the root, toward a shorter, thicker neck and body. The yield increased and the fleshy roots were more tender and easier to get out of the ground. The richer and mellower the soil, the quicker the growth, and the bigger the crop.

When the English colonists established themselves on the eastern coast of this country they brought with them seeds of garden vegetables, including the parsnip. They were surprised to find that the Indians were already growing this vegetable, and could not remember when it was introduced among them. It is known that it was brought to the West Indies and later established in Mexico by the early Spanish explorers. Possibly the Indians got it from this source during the hundred years between the coming of Columbus and the landing of the Pilgrims.

The English gardener has more foresight, I

A fine hill of sweet potatoes, the product of one plant

Garden beets are among the chef's most decorative vegetables

A great variety of delicious dishes are made out of the homely squash

think, and more patience than the American. He knows that the sowing of parsnips in spring, and the cultivation of the plants will bring a crop of tender, sweet roots, in prime condition, at a time when most fresh foods for man and beast are gone. What if he has no stock to feed, and there are more parsnips than his family needs? His neighbors will be eager to buy, as the late winter brings them to the end of their supply of root vegetables. The owners of cattle, pigs, and horses appreciate a chance to get parsnips for them. Poultry, too, thrives on these roots.

Parsnip seeds are grown for a drug they yield, and some gardeners grow their own supply for next planting. The second year is seed time for all plants that form fleshy roots in the first. Set out a parsnip in good soil and watch the top send up among the leaves the branching stem with its crowding umbrellas of little, greenish flowers, much like the white ones for its cousin, the wild carrot. The seeds are flat and round with a thin frill on each that enables it to fly.

## CARROTS

The wild parent of garden and field varieties of carrots is a rampant weed in most parts of

Europe, and has invaded America, via England. No greater nuisance distresses the farmer than this plant, for it takes possession of pasture and meadow land, and runs out the grass and clover. Only the plow and hoe keeps it from over-running field and garden, for its seeds are abundant, and the wind sows them.

Have you seen the roadside and hillside white in late summer with the lace umbrellas of the wild carrot? You have called them "Queen Anne's lace." The cluster is made up of hundreds of small, white flowers, in a flat-topped cluster, the big umbrella made of numerous little ones. Each arm of the much-branched stalk bears flowers. After blossoming, the umbrella turns wrong-side-out, forming a tight ball while the seeds are ripening. Each seed is ridged and roughened by prickly hooks, by which it is able to catch a ride on a cow's tail, for instance, if one brushes near by. The stems are brittle; so the heads are blown about by the wind, and the seeds gradually sown wherever they travel. The vitality of the seeds lasts for years. If they do not germinate the first year, they may later on. No wonder the wild carrot seems to inherit the earth, or a large part of it! No wonder it is hated cordially by farmers, and is considered one of their most dangerous foes.

Plant wild carrot seed in rich garden soil and the stringy, white root of the roadside weed becomes more fleshy. Save seed of this favored plant, and see still more fleshy roots on the plants that come from this seed. Vilmorin, a great French horticulturist, got a very creditable garden carrot in the third generation. Just as surprising is the change that comes to neglected plants of the best varieties: three generations of running wild will reduce the fleshy-rooted, tender carrot to the stringy, strong-flavored type of its wild original species. It reverts promptly.

Carrots have two distinct layers of flesh under the thin skin. The outer layer is richer in food elements and less fibrous than the inner one, which gardeners call the core. The effort to reduce this inferior middle portion and increase the nutritious outer flesh has succeeded in developing a coreless group of varieties. In shape, and colors, carrots offer considerable range for our choice. White ones are grown for cattle. For the table, carrots are red, orange, or yellow. From long, tapering roots they range to round, turnip shapes. Some of the choicest kinds are small and shaped like a frankfurter. There are early, medium, and late varieties; the last are among the best winter vegetables for storage in root cellars or in pits.

The Greeks cultivated the wild carrots over two thousand years ago. Their writers talk about it. In France and England, improvement has gone on nearly as long, until carrots are as common vegetables as potatoes. They are constantly used in stews and soups for flavoring, and boiled to be served alone or with other vegetables in salads. The very best way to cook tender young carrots is to steam them in their skins, removing these before serving with a rich white sauce.

An abundant supply of early, half-grown carrots come north from truck farms of Florida, while it is yet winter. These are among the most attractive things in market to those who have learned to enjoy the carrot flavor at its best.

Carrot seeds contain an aromatic oil, used for flavoring liqueurs. The red juice of highly colored varieties is used to color butter and sometimes as a dye.

## POTATOES

A family of plants is a group of different kinds which bears certain general resemblances to each other. The flowers are often the parts that exhibit these family characteristics, when other features are so modified that the members seem very far apart. The fruits of closely related

plants may be so changed by cultivation that they are scarcely recognizable as relatives of their wild parents, even.

The family to which the potato belongs is called Solanaceæ. In it are seventy genera, and these include fifteen hundred species. The genus Solanum covers the potatoes, the egg plants, the nightshades, and the bittersweet. The genus Capsicum includes the red peppers. Lycopersicum is the tomato genus. Nicotiana is tobacco. Datura is the Jamestown weed — or "Jimson weed." A genus includes petunias. Another, the ground cherries.

All these plants are alike in having alternate leaves, regular, five-parted flowers, with a single pistil, two-celled, maturing into a capsule or a berry, with numerous seeds.

The potato plant grows to maturity in one season and produces clusters of pale purplish or white, wheel-shaped flowers, followed by soft, green berries filled with very bitter pulp, that surrounds the little seeds.

Underground, the potato has a good supply of fibrous roots. Certain strong branches of the roots end in fleshy tubers. These have eyes, or dimples, with a bud, or a cluster of buds, in each. Later these buds prolong themselves into leafy stems.

This makes it plain that the tubers are underground stems, not roots. They act for the plant as storage places for reserve food.

Many potato plants have abandoned the habit of flowering, and rely for the continuation of the race upon the tubers, which are dormant through the winter, but sprout when spring comes. The potato plant dies like any annual. The tuber grows the second spring like the root of a biennial, such as the beet and parsnip. The farmer cuts up the "seed potatoes" into pieces with a generous portion of the starchy flesh to each good "eye." He plants these pieces, and each bud sends up a plant. These "cuttings" produce plants like the parent. Potato seeds rarely do this. The experimenting seedsman plants potato seeds in hope of discovering among the plants a new and desirable variety. Once in a hundred trials he may get something worth while. It is an interesting game.

High in the Andes of Chile and Peru the potato grows wild. It is common, too, along the coast. Related species are abundant in the highlands of Central America and Mexico.

The Spanish invaders probably brought it to Europe during the sixteenth century, and it spread rapidly through the southern countries. These same explorers may have been the means of estab-

lishing the potato as a food crop among the Indians that tilled the soil, for it was not known to them before the white men came.

Sir Walter Raleigh introduced both potato and tobacco into England. He grew potatoes in his own garden. Long after it had been grown as a garden vegetable, potato culture widened in importance until, during the eighteenth century, Scotland was raising potatoes as a field crop, and the French people were awake to its value.

The name, Irish potato, universally used to distinguish this vegetable from the sweet potato, came from the fact that the potato saved Ireland from the famines that recurred with terrible certainty until the potato was introduced. Now other crops fail, but the potato stands by.

Occasionally the potato crop is a failure. In 1845 a disease called blight attacked the foliage of the plants, preventing the formation of the tubers. This caused a potato famine over all this country and Europe. No such thing can happen again, for spraying the field with Bordeaux mixture, a solution of blue stone and lime, kills the fungus, and saves the foliage. Paris green, added to the spray, kills by poisoning the potato bug, which is the chief insect enemy of the crop.

It is possible to control the diseases and pests that caused the failures, partial and complete, of the potato crops, up to the time that spraying methods were perfected.

In Revolutionary times but two varieties of potatoes were generally known, a red and a white one. It was not known then, as now, that the vegetable is more important than most other garden and field crops, because it can be so cheaply raised, and so is within the reach of the poorest. By improvement in methods of cultivation the yield became constantly greater, and quality improved. The species tends to vary greatly, so new varieties were developed, and put on the market for "seed." Many thousands of varieties are in cultivation now.

Any one interested can create new varieties, or improve old ones. A few horticulturists in each of the leading civilized countries have devoted themselves to the raising of potatoes from seed. From their experiments the best new varieties have come into existence.

Americans like big potatoes: Europeans like little ones. We like white ones: they like yellow and red-fleshed ones. The flavor of a fine potato is more considered by the French and English than by us. Our potatoes depend for flavor on the

seasoning we add, for we eat the starchy part of the tuber.

The manufacture of starch and alcohol from potatoes is a great industry. Feeding potatoes to stock is a good practice. It puts a fresh vegetable element into the dry rations in winter that is both palatable and wholesome. Tons of potatoes put away in pits are opened and used in this way. Other economical methods include turning pigs into a patch of potatoes to root out the crop and fatten on it.

Like the other nightshades, potatoes have a bitter, poisonous sap in their stems and leaves. If a tuber is exposed to the sun it turns green, and its bitter taste warns us of the danger of eating it. Only potato beetles can eat the green parts of the plant with impunity.

When Sir Walter brought the potato over and presented the new vegetable to his Queen, he little thought the act might endanger his life. The plant was grown in the royal kitchen gardens, and the green leaves gathered and set before Her Majesty, Queen Elizabeth, in the form of a salad! Imagine how it tasted! Sir Walter was sent for, and faced the charge of trying to poison the Queen! He saved himself by explaining that only the tubers were fit to eat.

Cases of poisoning of children sometimes result from their eating the green balls that enclose the seeds, and look so good when served on the table in the playhouse. Timely warnings will prevent such occurrences.

Careful planters soak the potato cuttings in dilute formalin before planting, to destroy the spores of a potato disease called "scab." Two hours in the liquid insures healthy potatoes from the "seed." That means a clean crop that brings a good price. The cost of the bath is very slight, and the work is almost nothing. But the planting of scabby seed potatoes insures a crop that is scabby and a poor yield, because of the disease. Grain smuts are killed by soaking the seed in the same preparation of formalin.

A potato is a dormant shoot, set with buds, each with store of nourishment sufficient to feed its growth until it shall have roots and leaves to gather its own living from the soil and the air. If winter passes, and the tuber is not planted, it begins to grow wherever it happens to be. In the cellar bin the long, colorless shoots wind around in search of light. If there is a window, they all reach toward it. On the table in the light the shoots grow fast and produce green leaves, using the water that is in the fleshy substance, if none

is supplied. Before the old tuber withers away new ones may be formed. So the plant renews its youth, undiscouraged by adverse conditions, that would make most plants give up and die.

Grate a raw potato after washing and peeling it, and pour cold water over the pulp. Drain and squeeze all the liquid possible into a glass tumbler. At first it is milky, then a white sediment appears, and the liquid above it is clear. Dry the sediment, and it cracks like dried mud. It is caked potato starch, like the laundry starch we buy. The clear fluid that you pour off of the starch contains albumen, like white of egg. Heat the liquid and this coagulates. With the albumen is a small amount of sugar, and fat, and gum. These are the elements, combined with starch, that make potatoes so important a food. Dried, the potato would be about the equivalent of rice, and a much more condensed food than it is. Three quarters of the bulk of potatoes when they are dug must be counted out. It is water.

To get the very best out of a fine potato, one should cook it in its jacket. Scrub it with a brush, rinse away all dirt, and bake it. Or steam it, by placing it in a colander over a kettle of boiling water. If one must peel potatoes, let it be the thinnest possible paring that is removed. Under

the skin, that slips off so easily from new potatoes, lie the most nutritious elements. A thick paring throws away these, and sends the inner mass, chiefly starch, to the table.

Peeled potatoes should be plunged into hot water, so that the albumen coagulates and seals up all the contents when cooking begins. One gets by this method all the flavor and the value of the tubers. The common, wasteful method is to peel away the part in which the best of the potato lies, soak them in water, then put them on to boil in cold water. The water drained off when potatoes are "done" contains certain acids, besides other undesirable elements. For this reason, it has no food value, and should never be saved.

## SWEET POTATO

The Spanish name, Patata, comes from the Peruvian, Papa, name of a wild morning-glory, native to tropical South America, and China. The Spaniards learned to eat the sweet tubers that the Incas cultivated on the west slopes of the Andes. They are now grown in the warm parts of all countries, including the East and West Indies. China cultivated the vegetable some centuries before the Christian Era, so we can

hardly claim it exclusively as an American plant. It is one of those cosmopolitan "weeds," whose value was independently discovered on both sides of the globe, by hungry, primitive men, who nibbled any fleshy root that tasted good, and laid it on the fire to soften it by roasting or parching. The next step was to cultivate it. So the size of the tubers has been increased and improved by selection and better tillage, until we have almost one hundred varieties to choose from, and tubers weighing from one to twelve pounds are produced.

The range of this tropical plant has been extended until any region that has a growing season of four months free from raw winds and frost, can raise the crop. The best soil is a loose, sandy loam, well-drained. Growth must proceed without interruption.

The sweet potato plant is a creeping vine, related to the bindweed, dodder, cypress vine, and morning-glory, as its coiling stems and trumpet-shaped flowers prove. The seeds are borne in dry, two-celled capsules, more familiar to us in the morning-glory and moon-flower. Underground, the sweet potato forms the tubers, which are true roots, not stems, as in the "Irish" potato. No eyes are seen on the sides or ends of the sweet potato, but fibrous roots instead. The grower puts the tubers

into a bed of sand to sprout fully assured that buds will be formed, and stems rise. This peculiarity of a root tuber, the formation of buds, is not commonly met with. It is found in raspberry and apple and other fruits. Plant a bit of root, and a shoot rises to form a new plant. Cut down and try to destroy some trees, and leafy shoots rise from the tips of roots left in the ground. All such plants arise from buds that are called adventitious, and occur without definite order. They are abnormal and unusual. The sweet potato has come to be propagated by this method of root-cuttings.

The sweet potato is rich in starch and sugar and has a distinctive flavor that makes it a favorite root vegetable in many lands. The Northerner likes it to come to the table mealy and dry; the Southerner likes it waxy, or even sticky. A favorite Southern mode of cooking serves the "yam" in a syrup. Up North, butter and salt season it to taste. So the Southern grower is disappointed, if he sends any but dry, mealy varieties to Northern markets.

Quantities of sweet potatoes are canned. Some are evaporated. Sweet potato meal, glucose and even alcohol are commercial products. The vines are cured and fed as hay. Small and damaged

tubers are fed to stock. Bruising and cutting must be carefully guarded against in digging the crop, for the soil is full of fungous germs, and decay is quickly started in a tuber with skin broken.

We are fortunate to have this vegetable as a staple crop. In England it is not grown; a few varieties are hardy around Paris. The Europeans who have learned to like them must depend on imported potatoes. Of our great crop, a small part is sent abroad. The North African states send their surplus to European cities.

"Yam" is a Southern name, applied locally to some yellow-fleshed varieties of sweet potato. "Potato" is the name used in the West Indies. "Irish," or "white" potatoes, the true potato is called to distinguish it.

The true yam is a root tuber, like our sweet potato in composition and mode of growth, but belonging to an entirely different family. It originated in China, and from there has been introduced into Europe. It is hardy and wholesome. Its fault seems to be that the tubers go so deep that they are difficult to lift when mature. They are not yet a market vegetable in the United States, though a few amateurs grow them.

# Plants Whose Seed-Vessels We Eat

## CHAPTER VII

### The Orange and Its Kin

Citrous fruits, which take their descriptive adjective from the citron, include also the orange, lemon, lime, and pomelo, or grape fruit. The leathery, yellow skin, pitted with dots that connect with oil glands, and yield a pungent, aromatic fragrance, is a family trait always recognized. The pulp that surrounds the seeds is enclosed in papery divisions that part easily, making the fruit easy to handle after the skin is slipped off. The trees are evergreen, not large, but very productive; the foliage glossy, and peculiar in being compound, with but one leaflet. The flowers, waxy and white, and very fragrant, appear while the fruit is ripening.

First in this great family of semi-tropical fruits stand the orange. Native of Asia, the wild orange was cultivated early, and carried into India and China with the drift of emigration that set eastward, while it also moved westward into Mediterranean regions, and established itself in the sunny,

mild climate of Italy, Spain, and the south of France. Then came the spread of orange culture in the West Indies, Florida, and Mexico. And last, but greatest, the establishment of the orange as a commercial crop in California, an industry which has made a profound impression on the orange market of Europe and America.

The remarkable thing about the orange of southern California is that the fruit is picked ripe from the tree, packed with the utmost care, shipped in special refrigerator cars, or compartments in vessels, and delivered to the consumer in distant countries without change or deterioration in quality. It may be picked through a long season, so as to supply the market at almost any season of the year. The growers in this great new orange region of the world are people of high intelligence, who have founded their industry on the best knowledge obtainable. The experience of Old World growers has helped methods in use; but their prejudices and traditions have not hampered the progress of the new horticulture.

Just as good horticultural intelligence developed the orange industry in Florida. The advantage of nearness to the great seaboard cities of the East, and cheaper transportation by sea, gave a great stimulus to the planting of orchards, and in 1894

six millions boxes went to market. Then came the freeze in December, and another in February, and orchards north of the middle of the state were ruined or badly damaged. Large plantings in southern Louisiana were utterly destroyed. This sad lesson taught growers the limits within which orange culture can safely be pursued, and it left the way clear for California to supply the deficiency, by ever greater production.

The demand for oranges is large in the United States. California supplies 80 per cent. of it. The importation of Mediterranean oranges has largely given place to West Indian, and American fruit. England uses an ever-increasing quantity of California oranges of the finest grades.

The Washington Navel is the great commercial orange. It is seedless, with a funny little wrinkled orange, no bigger than a berry, tucked into the blossom end. The divisions of the fruit are many, the walls thin, and the flesh sweet and fine-flavored. The trees are small, but well-shaped and very prolific, beginning to bear early.

In 1870, a resident of Bahia, Brazil, sent to the Department of Agriculture in Washington three cuttings of the seedless orange, the principal variety of that country, grown for a century or more, but not especially good, and unknown in this

country, because it is not a good fruit for shipping. The cuttings were overlooked for some time, then sent to a grower at Riverside. Two of the scions lived when grafted on an orange tree.

Upon this new fruit the orange industry rests. The parent tree of the Washington Navel orange is now growing and bearing fruit in front of the Glenwood Inn, while trees by thousands represent the offspring of cuttings it has yielded in years past.

Strangely enough, the soil and climate of southern California makes of this variety a different fruit from the South American form. One of the chief merits of the Washington Navel is its keeping qualities in overland transit.

The harvest of oranges in California begins in time to supply the Christmas trade. Navels are picked and shipped from November till May. Valencias, a European, seeded variety, the best and most popular late orange, from June to September. Malta Blood, a red-fleshed, small fruit of excellent quality, from March to June. Mediterranean Sweets, of good size and few seeds, fine in flavor and texture, from April to July. St. Michaels, fine, juicy fruit with very thin rind, May to July. These are the standard varieties grown for market.

Tangerines and Mandarin oranges are loose from

the skin when ripe, and easily parted into sections without spilling any juice. They are sweet and pleasantly aromatic, grown chiefly for local demand.

*Kumquats* are tiny olive-shaped oranges, an inch long, thick-skinned, with scant room for pulp. They are eaten, skins and all, or made into conserves. They are a dwarf species from Japan.

The marmalade of commerce is made of the bitter orange, an Arabian variety, taken into Spain by the Moors in the ninth century, and cultivated chiefly in the neighborhood of Seville. The dark skin is candied for export to England and other northern countries. Quantities of the fresh fruit are used in English homes and factories, for the Englishman must have orange marmalade wherever he goes.

The *Citron* whose thick inner rind is candied and preserved in Sicily, Corsica, Italy, Spain, and Portugal, grows also in the West Indies and Brazil. It grows wild in northern India, from which region it has come into cultivation in India and China. It is not edible when fresh.

The *Lemon*, a close relative of the orange, originated in India or China, if tradition is to be believed. It has followed the orange over the world, but is a trifle less hardy. Its place in the list of

useful fruits is distinct, and lemon-growing is an important industry in Florida and southern California. England gets lemons chiefly from the Mediterranean citrous districts and the West Indies.

Lemons lose quality by hanging on the trees after they reach fair size. They are picked green, and from that moment "must be handled as carefully as eggs." In dark, but well-ventilated storehouses the fruit is slowly cured and attains its yellow color. The next step is the washing that removes dirt that the oily surfaces accumulate. From the washing machines, the fruit is dried, and then shipped or stored. There is no reason for hurrying lemons to market. Fruit picked in December will keep till July, if properly stored in airy boxes.

The *Lime* is a small green lemon with sour juice that furnishes a most refreshing beverage. The home of the species is northern India, whence it has been carried into the West Indies and Mexico, in this country, and widely scattered in Asia and Europe. England imports a great deal of lime juice. The varieties come true from seed. The plants are dwarfs, and are often planted as hedges.

The *Pomelo*, called "grape-fruit," because of the grape-like fruit clusters, is the largest of all

citrous fruits, and its popularity grows apace. It is an improved form of the shaddock, a native of the Malay Archipelago, and the South Sea Islands, coarse, bitter, and sour in flesh, and weighing from ten to twenty pounds!

The few years of selection and cultivation have developed a smooth-skinned pomelo, full of juice that is sprightly, but not bitter, and with a minimum of "rag," the tough tissue that separates the compartments of pulp. Nothing can be more delicious than such a fruit, served with enough sugar to temper its tartness. Orange trees are readily changed over to grape-fruit by budding or grafting, or *vice versa*. So any one in California or southern Florida who has overcome his first distaste for the new thing can supply his home table by converting two or three orange trees to the new fruit. It takes only a season or two to effect the transformation.

## GRAPES

The oldest cultivated fruit is the grape, a plant related to the Virginia creeper. Six thousand years it has furnished the human race with food and drink. In the old countries, wine comes first among the important products of "the vine." To

us, grapes are important first as food. We grow them to eat fresh, out of hand, as a table dessert, and to cook. Dried, they are a valuable food called *raisins* and *dried currants*. Bottling the unfermented juice is a great industry in the United States. Wine comes last, for, though California grows the wine grapes of Europe, and makes wine, Americans are not wine-drinkers, to any great degree, and Europe counts the wines of other countries inferior to those of her southern countries, where wines have been the most important product for centuries.

It was natural that the early settlers of the Atlantic coast should bring the grapevines of Europe with them, and try to raise vineyards and make wine. They failed, and they could not guess why. So they turned their attention to the native grapes, which grew in considerable abundance and variety in different regions. By selection, and tillage, some of the best grape varieties grown today have been developed from the wild, native kinds.

The Concord, one of the richest-flavored, and most popular of eastern grapes, was discovered as a chance seedling on his grounds by Ephriam Bull, a resident of Concord, Massachusetts, in 1843. He recognized the merit of the fruit, and propa-

gated this "sport" by cuttings. Now its range is extensive, and the fruit is shipped even to California, whose markets are loaded with the richest dessert grapes, of the sorts that Europeans grow under glass.

The Concord is the parent of the Worden, Moore's Early, and a number of other fine, but less famous varieties. But the original vine still flourishes where it was discovered seventy-five years ago.

The Catawba, another fine grape, was found wild in the North Carolina woods a year earlier than Ephriam Bull's notable discovery in New England. It has given rise to another famous seedling, the Diana, which is more popular than its illustrious parent.

In the American woods nearly two dozen distinct species of grape have been found. In Europe, southern Asia and North Africa native species have given, in the course of thousands of years of culture, over a thousand distinct cultural varieties. But the one species that is parent of the wine grapes is *Vitis vinifera.* No other country compares with American in wealth of species of native grapes.

The soft, juicy native grapes contrast distinctly with the thick-meated grapes of Europe. These

are in recent years quite common in the markets of all cities, being grown and shipped in refrigerator cars from California vineyards. The Flame Tokays, Cornichons, Mission, and Muscats are among these well-known and deservedly popular fruits.

Some of the finest varieties of cultivated grapes have been developed from crosses of native American species with the European vine. New kinds have been thus produced outright. The game of making hybrids is played by carrying the pollen of one species to the pistils of another, and preventing self-pollenation. Then we plant the seed set as a result of this hand-work at crossing. It succeeds best with species that do not grow alongside of each other, naturally. The wine grape and the American fox grape have produced some of the most successful of these artificial crosses; and the crossing of a hybrid with a native has produced still better varieties. Some of the good varieties are believed to be natural hybrids, crosses produced by the agency of insects or the wind, instead of the voluntary effort of experimenting horticulturists.

The grape phylloxera is a plant louse that feeds upon the roots of the vines, causing the plant to die. It was the cause of death to the European

vines first brought over in colonial times. Introduced into Europe, it swept the vineyards away, and ruined the wine industry. No grape-growing country has escaped a visitation of this plague of the vine.

But study of the ruined vines revealed the cause of trouble. No one could devise any means of killing an insect enemy that works underground. But the wild American vines, that showed ability to resist the attacks of the phylloxera, were taken to Europe and planted. Then the varieties that had been destroyed were grafted on the hardy roots. Thus the immune grape acted as nurse and guardian to the tender wine grapes, and the enemy was defeated. Rugged native species saved the high-bred varieties from ruin.

Wines are made by crushing the grapes and letting the juice ferment. The skins may be fermented in the juice and thus make red wines, that take their color from the pigment under the skin. Juice alone is used in making white wines. The acid in grapes gives the wine-keeping qualities. The sugar produces alcohol. During fermentation, a grayish or reddish crust forms in the wine vat. This crystalline substance is "argol." Refined, by dissolving and filtering processes, it becomes "cream of tartar," used in medicine,

effervescent drinks, and in baking powders. After being drawn from vats into barrels, the wines are kept for some years to ripen, if the best qualities are being made. The older the wine, the better it becomes.

Raisin-culture centres in Fresno County, California, where the fruit of certain fleshy, sweet varieties are dried in the sun, on large trays. Only regions of continuous sunshine can make raisins.

Valencia and Malaga, cities in Spain, are centres of great raisin-districts in Europe. The finest grades are produced by partially cutting the stem of each fine cluster, and then cutting away of all leaves, so that the sun hastens the drying, and the sap supply is partially cut off. The more usual method is to cut the bunches and lay them on trays in the sun.

Persia and neighboring countries produce quantities of raisins for home use and for European markets. The Zante currants and Sultana seedless raisins are both made of small sweet grapes of Greece and Asia minor.

## CORE FRUITS

In the great Rose Family we find a number of the most important genera of trees, whose seed

envelopes man has developed by the arts of horticulture into luscious and wholesome fruits. Beside trees, the family embraces shrubs, herbs, and vines known for their fruits as useful and beautiful additions to the fruit and flower garden.

The core fruits are the apples, pears, quinces, the medlar, and loquat. The seeds are borne in a papery, five-celled ovary, surrounded by the fleshy "pome," which we eat. The most important of these core fruits is the genus Malus, the apple.

### APPLES

The parent of the apples of the orchard is a scraggly tree with sour, crabbed fruit enclosing the core and seeds. It grows wild in the southeastern parts of Europe, and the neighboring countries of Asia Minor. From these parts it moved with the drift of population westward, and was gradually improved, until now it is grown throughout the North Temperate Zone, and is spreading in South America, Africa, and Australia. Along with civilization, the apple has marched for unnumbered centuries, the little nubbins found among the remains of the early Lake-dwellers greatly improved upon by the apples of classical literature. The varieties shown at a horticultural fair in any country to-

day are all lineal descendants of that first wild type.

The method of multiplying a good variety has been by grafting (or budding) a scion of the desired kind on a healthy apple tree whose fruit may not be counted so desirable. The scion unites with the stock, and through it a branch is produced that bears the fruit desired. On small trees, the top is made by the grafting process. One scion is set on top of the main stalk, and through this twig all growth is changed over to the new variety. The root and stem minister to the bearing top which is not their own, but a relative by marriage!

To find out in the easiest way what that ancient parent apple was like, we must stop on the wayside and taste the fruit of a tree that has sprung from a chance seed of a core thrown away by some traveller who passed by, years ago. Gnarled is the tree and insipid the fruit! Plant an orchard with seeds of your favorite apples, and wait for them to bear. The wild apple of the wayside had quite as good fruit as that you will get. Seedling apples are uncertain for the orchardist. He makes his choice of varieties and plants trees grafted to these. The plant breeder may grow seedling apple trees in hope of discovering one in a thousand that bears

The growth and yield of a grapevine is a miracle repeated each year

In an irrigated garden black-cap raspberries are luscious fruits

good fruit. He plays a game with Nature. Once in a lifetime a fine seedling variety is discovered. Such is the Wealthy apple, discovered in a Minnesota experimental orchard some years ago. The Fameuse, or Snow apple, comes true from seed. For centuries it has been passed along by seeds carried and sent into new territory, in Canada and the United States, from its home in France, until it is distributed across the country.

The native wild apples of this country are to be found in the woods to-day; we call them wild crab-apples. The eastern species is the only one the early botanists saw. Later, another kind was found from New Jersey to Florida, and westward, — the narrow-leaved crab. In the central states the Iowa crab, and in the northwest the Oregon crab, make four species of wild apples in North America. Siberia has a wild crab, parent of the cultivated crabs we grow in gardens. These little apples are distinct. We use them for jellies and sweet pickles.

Notably good fruit has resulted from crossing different species of wild apples. Some natural crosses have furnished good kinds. The Indians used the wild apples for food, and were quick to adopt the varieties introduced by settlers. In North and South America remnants of Indian

apple orchards still persist, where their cornfields have been obliterated years ago.

Apples grow far north, but they require a hot summer to come to good size and color and fine flavor. The climate makes Nova Scotia one of the best apple countries in the world.

Canada is a great apple region. Vermont and northern New York, with their cold winters and deep snows, produce apples of the finest quality.

Great apple regions in the Northwest and in Colorado, California, and other states are supplying an ever-increasing demand for the fruit in the states west of the Rocky Mountains. Some of the finest apples in New York and London are grown in the Northwest.

### PEARS

We have no native species of pear, though we cultivate a number of varieties, imported from Europe, and some fine kinds have originated here. The original home of the wild pear was not far from that of the wild apple, but it has spread in two directions until it is a common forest tree in France, and from the Chinese forests it reaches north to Manchuria.

Special success has attended the efforts of the

French and Dutch horticulturists to improve this fruit. Choice varieties were developed by monks who trained the trees on walls so that the ripening fruit should have full benefit of the sun's heat, and defence against cold winds. This method produces fine pears in England, which has too cool a climate, and too little sun to ripen pears in any other way.

## QUINCES

In the gardens of New England you will find dwarf trees that blossom with lovely pink clusters of flowers like wild roses, and bear golden apples in the fall. Taste one, and its flesh is too hard to eat. This is the old-fashioned quince, cultivated from the earliest times, when it came into cultivation from the wilds of North Africa, and southern Europe, and from the slopes of the Himalayas. It was revered by the ancients: it is revered to-day by the housewife who inherits and tries to live up to the traditions of her mother and grandmothers. And who can do that unless she has in her fruit cellar stores of quince preserves and jelly? "Marmelo," is the Portuguese name for the quince; so other fruits are masquerading in borrowed finery when they are preserved under the label, marmalade. The peculiar change of the white flesh

of quince to deep red while cooking is shared by no other fruit I know.

Quince trees grow slowly, and attain no great size. For this reason seedling quince trees are used as stocks on which to graft apple and pear scions, when dwarf trees are desired. The slow-growing stock checks the rate of growth in the top, and induces the habit of early fruiting.

From Japan we have imported a species of quince that bursts into a flame of red blossoms before the leaves are fairly out in spring. It is an admirable hedge plant. The fruit is not edible, but is very fragrant, and is sometimes laid amongst linen in bureau drawers. The Chinese wild quince we rarely see in America.

### MEDLAR

The medlar is a wild fruit tree from the woods of central Europe. It is soft-fleshed when ripe, but is indifferent in flavor, and is only occasionally grown as a curiosity. The core is exposed at the blossom end, as if there was not quite enough flesh to reach around the seeds. The only use made of the fruit is for preserves, or to nibble at when frost has softened the pulp.

### LOQUAT

A small, pear-shaped fruit, scarcely as large as a plum, with yellow skin and a pleasantly acid taste, grows wild in China and Japan, and is called the loquat. Introduced into California, it is common in the fruit stalls in Los Angeles. It thrives in southern Australia, and is one of the common market fruits in Sydney and other towns.

### STONE FRUITS

Plums and cherries, peaches and apricots are stone fruits. The pulpy flesh encloses the single seed, which has a hard shell, like a nut. The trees have a resinous sap that flows out to heal wounds in the bark. The drug, hydrocyanic acid, gives the characteristic bitter taste to the sap and the pits of the fruit. It is poisonous, but does not affect the flesh. Stone fruits have been improved by cultivation until they represent one of the important fruit groups of the Temperate Zones.

### PLUMS

The European plums have come from ancestors that grow wild in the Caucasus and Asia Minor. The woolly-twigged varieties we see in New England gardens, and in better condition on the

Pacific Slope, the Damsons and Green Gages, for two examples, are from European nurseries, originally. They do poorly in other sections of this country.

For this reason, horticulturists early began the improvement of our own wild plums: the low beach plum of the Atlantic coast, the Canada, the Chickasaw, the wild red, and the sloes of the Southeast. Each represented a large section of the country, and in the centre the Wild Goose, a natural hybrid appeared, which is the parent of two fine groups of cultivated varieties: the Miner of northern orchards, and the Wayland in the South. So this country is particularly rich in plums.

Prunes are dried plums. The varieties suitable for drying are sweet and firm-fleshed. The city of Tours is the centre of the prune district of France. California raises quantities of prunes.

Japan has contributed some fine new varieties to the American plum orchards, some of the largest and finest being grown on the Pacific coast states.

## PEACHES

First among the members of the stone fruits, by reason of size, lusciousness and flavor, stands the

peach, native of China, probably, but long in cultivation in Europe and all countries that touch the old highway through Persia to the Mediterranean. The Chinese cultivated it at a remote period, and it was carried into Europe three centuries before the birth of Christ. The early colonists brought it to America; here it thrives in all sections that have a mild winter climate.

A peculiarity of the peach is that the pit is very rough, while the pits of plums, apricots, and cherries are smooth. Another is that some varieties are clingstones, others freestones. The fuzzy skin of a peach is thick or thin, according to the variety, red or yellow, the flesh yellow or white. Occasionally smooth peaches occur with furry ones on the same tree. A tree that has borne peaches may produce a crop of fruits that are all smooth. Or half of the limbs may bear one sort, and the rest the other. Indeed, a single fruit may be half furry and half smooth.

A smooth peach is called a nectarine. The seed of a nectarine will almost always produce a nectarine tree. Yet the peach is counted the parent and the nectarine a changeling child, a "sport," illustrating the fact that in plants and animals there is no law so stable as the law that produces constant variations from the type. The offspring

most unlike the parent is often the one most able to survive.

The English gardener raises delicious peaches under glass, and trained on south walls where they can get all the sun possible. The sunnier lands to the South grow the fruit to greatest perfection. America has large orchards of varieties that are solid enough to stand packing and shipping, as the dessert qualities could not do. The canneries take care of the surplus, so we get from market, fresh and canned, plenty of this wholesome fruit. But in order to know what excellence the peach can attain to, one must raise a few trees of the best French varieties in a greenhouse, and let the tree carry the fruit until it is soft under a gentle pressure of the ball of the thumb.

### APRICOTS

The apricot is a woolly plum, or it may be more accurate to say that the plum is a smooth apricot. Botanists and horticulturists recognize the close relationship between the two groups of species. They both belong to the genus Prunus. From the woods of Armenia the apricot has been carried to all parts of the world. Apricots are in the markets of California and other warmer states in Australia

and South Africa. Italian apricots are among the finest. There are many varieties. Dried apricots are an important export from northern India to Thibet and the provinces of western China. In the oases of upper Egypt a variety with sweet kernels is raised. Here the dried flesh, and the nuts are both articles of commerce, and staple foods of the people. The name of this fruit is "Musch-Musch."

### CHERRIES

Four wild species of cherry grow in the woods of America, and not one has yet shown any disposition to become large and sweet, like the cherries of our gardens and orchards. We grow sour cherries for pies, and sweet cherries that are delicious to eat fresh out of hand. The two types are distinct, and both originated in wild species that still grow in different parts of Asia Minor, Persia, and the north of Africa. It is strange, but true that European cherries grow well with us where European plums fail, and our native cherries fail to fill the breach, as our native plums have done.

The Japanese cherries are highly cultivated varieties, but the blossom, not the fruit, has been

the subject of improvement. Many varieties do not fruit at all, but have blossoms so wonderful that the whole nation turns out to view the gardens in May, the cherry-blossom month, one of the great national fêtes of the year.

## THE CANE FRUITS

Brambles, we call the long-armed plants of the genus Rubus, which cannot hold themselves erect, but sprawl on the ground, and make a thicket by sending up suckers or by striking root at the tips of the arching canes. The difficulties of walking through or past such plants are increased by the prickles that turn their points backward.

The raspberries of our gardens are descendants of wild brambles that are abundant in the wilds of North America, Europe, and Asia. The rough surface of the fruit suggested the name. Black, white, red, and yellow varieties are grown. The wild "black caps" are our native raspberries, often very fine fruit in rich, woodland soil, but usually the better for cultivation.

Blackberries are a famous wild fruit in many parts of this country. The *bush blackberry* of the eastern states has many cultivated forms, widely

distributed. The *dewberry* is a trailing blackberry with sweet, large, fine-flavored fruit. It is known in several fine varieties.

The loganberry is a wonderful large blackberry with the flavor of the red raspberry, and some of its color. It was a chance hybrid, produced in 1881, by crossing the wild blackberry of the Pacific Slope with one of the red raspberries cultivated in a California garden. The new form is splendidly vigorous in growth, and produces more and better and bigger berries than had been known on any cane fruit.

Judge Logan, of Santa Cruz, was honored for his discovery. The loganberry is one of the great gifts to horticulture. It is grown in California most abundantly, but has been established in the east, and other countries will have it in course of time.

Next comes "the Wizard of Santa Rosa," Luther Burbank, and crosses the native dewberry with a red raspberry. The result is a new fruit that outdoes the loganberry in all its good points. It is called the Phenomenal. The Primus is another Burbank triumph. It is a huge, fine raspberry, the size of a large thimble, but the centre is pulpy and sweet. The parents of this fruit are a blackberry and a raspberry.

## THE BUSH FRUITS

Currants and gooseberries grow wild in both the Old and the New World, and are cultivated in a multitude of improved varieties. These are tart, spicy fruits, fine for jelly and jams, and for stewing, green or ripe. The largest gooseberries are the size of plums, and sweet enough to eat out of hand. The cherry currants are equally fine as dessert fruit in the natural state, when fully ripe.

We who have picked the small, but sprightly, green gooseberries of the woods, both the prickly and the smooth ones, know that no cultivated form, no matter how mild it is, can excel in rich flavor the sauce they make. It is worth while to grow wild gooseberries, in order to have them spiced for serving with roast fowl and game in winter.

## FINE WILD BERRIES

Cranberries grow in boggy land in various parts of North America, and Europe, and require to be flooded during the winter time to keep the plants from freezing and being heaved out of the ground. Flooding of the lower parts of the plants during growing time is practised; but with the approach of autumn, which is the season of harvest, the

bogs are drained in order that the picking can be done.

The oval red berries are less than an inch long, thin-skinned, with small seeds in a corky white pulp. They look very pretty on the branches of the evergreen bushes that stand close, a foot or so in height, and look like a level, green velvet carpet.

The bog is laid off in strips by the stretching of ropes, and the pickers gather the berries by hand, or with rake scoops, that comb them off, wholesale.

Cape Cod is the biggest cranberry region in the East. Wisconsin and Michigan have large areas from which this crop is marketed.

Huckleberries, whortleberries, blueberries, and cranberries, all are names that call up memories of delightful berrying expeditions into the wilds, and delicious tarts, pies, and preserves made of the fruit at home. It is hard to believe that cultivation can add to the value of these wild species. Some attempts have proved that great increase in size is to be expected, when the work is seriously taken in hand. The only way to improve them, we think, is to multiply the available supply, and bring them where everybody can have all he wants.

## STRAWBERRIES

Babes in the woods, in the folklore of various countries, have eaten wild strawberries, and been covered over with strawberry leaves, when their rescuers were slow to find them. The scarlet, or Virginian strawberry was transplanted from the woods and fields into the gardens of the early colonists. In the Middle West, the pioneers found the lusty, wild Illinois variety. On the Pacific Slope two or three native kinds grow at different elevations. In Europe, the wild species are the wood, or alpine perpetual strawberry, the *hautbois*, or musk strawberry, and one or two beside. All these have been brought into cultivation centuries back. The ease of transplanting or of raising them from seed left no excuse for omitting this delightful fruit from the home garden.

While the American horticulturist was struggling to tame the wild strawberry of the east coast, which repaid his efforts only by running to luxurious vines instead of to fruit, a wild species, taken to England by travellers in Chili, suddenly absorbed the attention of all horticulturists. It became the parent of a remarkable line of garden varieties, through crosses with the wild and culti-

vated strawberries of Europe and America. The garden strawberries of this country trace their ancestry to this Chilean species. But the strange thing about it is that we cannot succeed with the Chilean plant when it is brought from our west coast, where it grows wild. It must come by way of European gardens.

The flavor and color of our own wild strawberries are deserving of perpetuation in gardens. But who can blame the discouraged gardener for dropping everything else, and grasping the new opportunities that opened to him when the Wilson variety appeared! It suddenly became possible for every garden to have a bed of strawberries with big clusters of luscious fruit. Until the Wilson came, no strawberries were seen in our city markets, and none were grown outside the special gardens of the rich. This wonderful discovery, that everybody could have all he pleased, came about 1854.

A few people I have known were unable to eat strawberries. But it was not because they did not like them: they keenly felt the deprivation. We all think, as did Doctor Boteler in "The Complete Angler": "Doubtless God could have made a better berry, but doubtless God never did."

The name of the genus is Fragaria, meaning

fragrance, one of the delightful qualities of this delicious and beautiful fruit.

Growing strawberries for market is hard and exacting work, requiring that the worker stoop continually in taking care of the plants and picking the fruit. To get the berries to market in the best condition requires that they be picked at just the ripe state, and kept from being roughly handled in transit. The best way to have perfect berries is to grow them. This can be made a delightful pastime, free from too much hard work. Get plants of the best possible variety and grow them to perfection. That is a job that brings its own reward.

To enjoy the growing of strawberries one must know the habits of the plants. From the crown a thick brush of fibrous roots go down, and a number of leaves go up. Among the leaves the flower stems rise, and fruit follows the flowers. After the fruiting season passes, the plant sends up long stems that creep out in all directions, and strike root at the joints. So these looping "runners" set out new plants, wherever they get hold of the soil. The stems between the new and old plants die, in time, and a family of vigorous, and independent youngsters surround the parent.

Another method of producing new plants is

The banana plant is a giant, but its lifetime is a single summer

Nobody is unhappy here but the dog

scattering seeds. Birds eat the berries, and the seeds, scattered abroad, grow the next summer into full-sized plants. From seedlings some of the good varieties have originated. The runners are like the parent plant. The seedling is likely to differ, though some varieties "come true."

One of the discouraging facts about strawberry culture in the early stages, fifty years ago, was the failure of a bed to produce berries, even though it received the best care and blossomed profusely. A study of the flowers solved that problem.

The blossom of a strawberry plant is like a white rose, with a single row of white petals around a cone of pistils. The stamens, many or few, are set on the petals, and form a ring around the cone.

Sometimes the stamens are so few or so weak that they do not furnish pollen to fertilize the pistils. This results in the withering away of the cone. The cone grows into the fleshy berry, when seeds are set. If the top of the cone, only, fails of fertilization, that part withers, and the berry fills out only in the portion next to the calyx, or hull. Such a berry is called a "nubbin."

A variety that is unable to set fruit because its flowers produce insufficient amount of pollen must be planted with one that produces copious supply,

and blossoms at the same time. The wind and insect visitors scatter the vitalizing dust, and a fine crop results. Experiments have found out what varieties are best suited to be planted together. Before a bed is set out, a practical grower in the neighborhood should be consulted, and his advice followed.

The way to get the best plants, and the quickest crop from them, is to sink little pots of rich earth under the best rooting joints of the runners, choosing the parent plants for their vigor and the quality of their berries. If started in July, a mass of roots will fill each pot before the end of August. These independent plants may be set out in the prepared bed in September, without disturbing the roots. By the time the threat of frosty weather requires that they be covered with a protecting mulch they will be well-grown, and will set lusty fruit-buds in the coming spring. Some amateurs tear up the bed after this first crop is picked. Others think the second crop the best from pot-grown, fall-set plants.

## PINEAPPLES

Once an irate commission merchant in a northern city wrote a letter to a pineapple grower in

southern Florida, charging him with sending second-rate fruit. The consignment contained many imperfect specimens. He threatened dire consequences if any more "windfall pineapples" came his way! The south half of Florida still laughs, though the joke is old.

The largest pineapple orchard in the United States is near Fort Myers on the West Coast. This tropical fruit is sensitive to cold and dry air. It grows only in the lower part of Florida. Even southern California has given up the attempt to raise it.

A field of pineapples ready to harvest does not look like an orchard. The plants grow in rows and hills, like corn, and each bears its one fruit on the stout central stalk, about a foot above the ground. Around it arch the long, thickened, sword-like leaves, very prickly on the edges, and at the tip. It would be a hurricane, indeed, that produced any windfalls of this crop.

The negroes that gather the "pines" wrap their legs up to the knees with the thickest cloth they can find. Strips of carpet are best. Then they put on mittens or gloves made of thick canvas, and go into the field with short, hooked knives, and gunny sacks slung across the shoulder, and hanging open under one arm. Grasping the spiny

leaves at the top of the fruit, the harvester cuts off the stem at its base, and "chucks" the pine into his bag. The saw-like leaves scratch viciously at him as he passes on to cut the next ripe cone, and when he goes to empty his bag into the crates, distributed from wagons through the field.

Often I have seen the picker toss the fruits, as he picks them, to a man outside the rows, who catches them skilfully, and lays them uninjured in the crates. From the field, the filled crates go to the packing sheds, where each sound pine is put into a paper bag about its size, and closely packed in crates that are loaded onto cars or into vessels bound for distant cities. The processes are very simple, and the solid fruit ripens in transit.

New plantations are set with suckers, or offsets, that spring out around the base of the pineapple, or the stalk below it. The wild plant has seeds, but cultivation has discouraged seed-production. The seed-vessels become the fleshy substance behind the "eyes." In the best varieties, even the core is soft and luscious.

There is no more refreshing fruit in the world than ripe pineapples. But we must eat them in the field, or at least close to the place in which they are grown, because fully ripe ones are not able to

travel; and those that are cut when less than ripe never attain perfection.

The native Floridian sits down to rest, and cuts the rough outside off of a big "sugar loaf," as a Yankee would peel an apple. Then he slices it across the bottom, and eats the slices, holding the uncut fruit by the leafy top. Does he eat a whole one? Bless you, he has only started in! One, two, or three are not too many to quench the thirst of a man. The Northerner gasps to see fruit that at home would cost over a dollar disappearing down the throat of a loafer who has jogged out from town to see how the harvest is coming on. Nobody chides him for coming.

Quantities of pines go north from the West Indies, whose climate produces fine fruit. Brazil, the native place of the wild pineapple, raises a considerable supply for export. The cultivation of the fruit has spread to the Tropics of Africa and Asia. For a long time English gardeners have raised the finest kinds of this fruit in special hothouses built for the purpose.

The leaves of pineapple plants contain valuable fibre. We see it in the wonderful piña-cloth, imported from the Philippines. The natives of the Islands of the Malay Archipelago also strip and wash out the fibre, using primitive comb-like tools

of bamboo, and taking infinite pains. The attempts to invent a machine for getting out the fibre cheaply have failed, so far, in this country. So the leaves are cleared off and destroyed, at some expense and great inconvenience, to get ready for the next year's crop.

## FIGS

The rich, sugary, amber figs that lie packed tightly together in boxes shipped from faraway Smyrna, in Asia Minor, should form a part of every child's Christmas. They are a delicious and wholesome sweet, both food and candy. Americans use them increasingly in desserts and cakes. Tons are imported every year from the warm countries to the east of the Mediterranean Sea — from Turkey in Europe and in Asia.

Why not grow our own figs? That question has been asked by people who see fig trees growing luxuriantly in various regions of the United States. Anybody who takes the trouble can raise fig trees from seed, and the trees are hardy as far north as Philadelphia.

They grow thriftily and fruit abundantly in the warm states. One, two, and three crops a year, almost without attention — white figs, black figs,

purple, and golden — the trees produce. Splendid fruit for eating green or ripe, for preserves, for fattening hogs. But for drying, for taking the place in commerce of the Smyrna fig, practically worthless. Here was the rub.

Trials without number were made with seeds of this imported fig. Time and again cuttings were brought from Smyrna and planted in California and in the South. Some of them grew and set fruit, but invariably it dropped before maturity.

Now we shall have to stop, as the fig-growers did, and study the peculiarities of the fig tree, which in many of its ways will surprise us. The scientist came to the rescue of the fruit-growers, and the result is that the best Smyrna figs on the market to-day are home-grown. But the industry was not born until the puzzling problem was solved by experts in the United States Department of Agriculture. This happened in 1899.

There is a general idea that fig trees do not blossom. Yet the fruit is full of seeds, and seeds follow flowers. You will see little green figs coming out between the leaf-stem and the twig, just where buds appear on other trees in late summer. These fat little buds never open; they just grow until they reach the size of a hen's egg, then

soften and turn brown or reddish, or the green merely fades out.

To find the fig blossoms, one must cut open the green body of the fruit. There they are, hundreds of tiny flowers that stand close as the disk flowers on a head of sunflower or dandelion. Draw together the edges of a sunflower disk, and you make a bag, with the flowers lining it. The fig is like that: the fleshy receptacle forms the wall of the sac. One little opening leads from the outside world. A small dimple in the end opposite the stem shows you this door. It is important that you see it.

Under each little flower is a seed. Break open a ripe fig, and the seeds are thick, under the pointed remnants of the many flowers. Mulberries and figs are closely related. The mulberry in flower has its receptacle covered with crowded, tiny flowers, each of which produces a soft berry, that is one of the many crowded together in a single mulberry fruit an inch long. If we can imagine a mulberry with its tiny berries on the inside it would be made like a fig. A fig turned inside out would be changed to the mulberry pattern. The likeness of the two is in having many flowers attached to the surface of a fleshy base. No matter what shape this base takes

in growing. It is the part that is sweet and edible.

Now, the setting of seed depends upon the pollenating of the flowers. Some are self-pollenated. Some require cross-pollenating by wind or by insect assistance. The Smyrna fig is one that cannot set fruit by itself. That is why the little fruits fall. No use to form fruits with no seeds in them. So the imported trees seem to think.

In the orchards of Turkey, wild figs, the Capri species, with plenty of pollen, but worthless fruit, are planted. So the investigators from America sent the wild species over to plant in California fig orchards, thinking that this would solve the difficulty. They also sent word that the Smyrna growers cut off the wild figs and hung them in the trees of the cultivated sorts, to make the setting of fruit sure. This was done in America. But the small figs kept on dropping.

Is the pollen ripe just when the flowers are ready to be fertilized? How in the world does it get in through the narrow door of the fruit? How does it get scattered inside, so that hundreds of stigmas receive it? These questions put the scientist on the right track. He set a watch upon the Capri fig trees and the Smyrna trees in their own country.

Meanwhile, Mr. Rœding, up in his orchard in Fresno County, California, was able to get the answer: "Yes!" to the first question. He took pollen from the Capri figs and forced it into the Smyrnas' doorways, tagged the fruits thus treated, and waited for results. The tree dropped all the fruit but the ones that received the pollen he administered by hand. They swelled to full size, ripened, and had the fragrance, the flavor, and the sweetness of the Smyrna figs at home!

This was in 1890. The missing link was now sought with all diligence, and found in the orchards of Turkey. A tiny wasp, so small as to be almost invisible to the naked eye, was seen to enter the "eye" of the Capri fig, and the same insect was found in the other figs at blossoming time. The magnifier discovered this hungry wasp searching each individual flower for its sac of nectar. Once identified, it was easy to recognize the fact that these midge-like insects were not at all scarce. The industry of fig-culture depended upon them! Without them, the whole world would go fig-hungry.

How startled the nectar-loving little Blastophaga would have been to learn what a grave responsibility rested upon her — meso-thorax! (Insects do not have shoulders.) Is an insect ever

conscious of the fact that it carries pollen from flower to flower? Never! She cannot avoid smearing her legs and body with sticky nectar, and dragging over the powdery stamens and the waxy stigmas, all ready for the vitalizing dust that enables them to set seed. But the insect is all unconscious of doing a work for the flowers, or the tree. She is selfishly gathering stolen sweets. Her own well-being and that of her growing family are her sole aim.

Turkey in Asia and California are many days' journey apart. Often captured Blastophagas were shipped to America, but they died on the way. I suppose it is hard to give sufficient air in a package that contains insects small enough to go easily through the meshes of ordinary cheesecloth! It is hard to supply them with proper lunch for two or three weeks. But the difficult undertaking at last succeeded. And the immigrant wasps took up their abode in the Capri figs, and made themselves at home in the sunny climate of California. The year 1899 saw our first crop of Smyrna figs ripen on the trees, as the result of the bringing in of the Asiatic wasp that fertilizes the flowers.

The grower "caprifies" his trees by hanging fruits of the wild Capri fig in the branches of the orchard trees, and thus making the distance short

that the insects have to go for their nectar supply. Of course it is imperative that the wild species be planted near by. Only a few are needed to supply many of the fruiting kinds with pollen.

Now the nurserymen who supply young trees for an orchard of figs send the necessary number of wild ones, and when the time of fruiting arrives, (and that is within three or four years of the setting of the trees) he sends a supply of the wasps to get them established in the orchards. Usually after the first supplies are received, the grower pays no more attention to the means by which his fruit is set. Nature has established an automatic system of reciprocity between the insect and the tree, and the owner has only to gather his figs and market them.

The giant fig trees of California are the wonder of the visitor, used to the comparatively small orange and other orchard trees he has seen. One veteran, planted in 1856 on the Rancho Chico, spreads 150 feet, and its branches, by striking root, form pillars, like the banyan-tree of India. This reminds us that the fig and the banyan-tree and the India-rubber tree are first cousins — members of the same genus, Ficus. The sticky, milky juice of the fig, that gets on your fingers when you

pull a ripe one from the tree, is not unlike the milky *latex* which hardens into rubber.

### BANANAS

Thirty years ago few people outside the large cities had ever seen a banana—fewer by far were those who knew and liked the taste of the fruit. Surprising changes have been brought about by the growth of commerce between this country and the West Indies. The poorest family in the smallest inland village can afford to eat this tropical fruit, for it is everywhere, and usually it is the cheapest to be had.

To see banana plants growing we may have to go no farther than the city park, even if we live in the region of cold winters. Started in greenhouses, they make an interesting tropical feature of the mass-planting in the border, or the high centre of a round flower bed. Such plants remind one of huge corn stalks, though the leaves are broad sheets of green that are soon slit into strings down to the strong midrib by flapping in the wind.

In the southern states the season is so long that these plants blossom. The single huge bud turns down, and begins blossoming by lifting the purple bract that sheathes the oldest and uppermost

group of flowers. Gradually the sheath drops, the showy stamens fall away, and finger-like green fruits in the familiar "hand" of eight to fifteen bananas are seen. How near these come to ripening depends upon the latitude and the season.

Warmth and sun are supplied in a narrow belt that crosses southern Florida. This is the northern rim of the "banana belt" that covers the West Indies and Central America, and on around the globe. Southern Louisiana, Texas, Mexico, and southern California have paying banana plantations within a narrow area.

The banana stalk grows in the Tropics to a height of thirty feet. This is its maximum, of course. In ordinary plantations no such giants are seen. Fancy harvesting the single clusters of fruit from such stalks! The rootstocks underground live on, sending up new shoots, which reach maturity and fruit within a year or eighteen months from the time they start. Immediately after fruiting the stalk dies. The planter's job is to cut out these stalks as fast as he harvests the fruit clusters.

The fruit is cut green but full-grown, and put directly into the hold of vessels that sail without delay for northern cities. The jobbers have cars in waiting to distribute the cargo to inland points.

So, with the least possible delay and handling, the crop moves to the consumer. Cold storage is not for bananas. But in the cool atmosphere that suits them they gradually ripen, and hung in the grocer's windows, turn from green to yellow.

The big yellow Martinique is the most common variety we have. The crimson fruit of the Red Jamaica is occasionally shipped in, and is used in making up baskets of fancy fruits. We rarely see the kind called plantain, that is not sweet, but is cooked as a vegetable in all tropical countries. The fruit of one of these coarse plantains in East Africa is about the size and shape of a man's arm!

A traveller in the Far East describes the great golden bunches of bananas heaped by the tons in the market places of cities of Java, and cheap beyond belief. "The Java *pisang*, or banana, however, is but a coarse plantain with pinkish-yellow, dry pulp, of a pumpkiny flavor that sadly disappoints the palate. Yet it is Nature's greatest gift in the tropics. Every tiny village and almost every little native hut has its banana patch or its banana tree, which requires nothing of labor in cultivation, save the weeding away of the old stalks. Four thousand pounds of this food will grow, without human aid, within the same space of ground required to raise ninety-nine pounds of

potatoes or thirty-three pounds of wheat; both of these northern crops acquired, too, only by incessant sweat of the brow and muscular exertion. The pisang is the tropical staff of life for white as well as natives, as wholesome and necessary as bread, and an equivalent of the latter as a starchy food. It comes to one with the earliest breakfast cup, appears at every meal, arrives with the afternoon tea tray, and always ends the late dinner as the inevitable accompaniment of cheese."

The popularity of our yellow banana is partly due to the very convenient package it comes in, and to the fact that it is not sticky nor messy, nor does it need "fixing" before children can eat it. The tough skin keeps the soft inside clean, yet it parts easily enough. The seeds have been dwarfed to mere remnants by generations of reproduction by suckers.

Banana meal, made of the dried flesh of ripe or green fruit, and evaporated slices are on the market. In this form we may know what the fruit tastes like when it is not cut green. New recipes for cooking bananas give us added pleasure in this nutritious food. It has come to be ranked one of the good salad fruits, when used before it is dead ripe. It is served with Mayonnaise or French dressing, alone or with nut meats.

Two members of the banana group have inedible fruit, but are useful for the fibre they yield. Manila hemp is obtained from the leaf sheaths of the most important species. The leaf blades of others are tough enough for papers. Coarser ones are split and the dried strips woven into baskets, mats, and bags.

Starch is made from the fleshy rootstocks of an African banana.

### MELONS

The family of the cucurbits includes both vegetables and fruits. Here the squashes, pumpkins, and cucumbers hobnob with the watermelons and canteloupes. All are fleshy seed-vessels, with abundant seeds, attached along three distinct areas of the wall of the cavity of hollow kinds, and similarly located when the flesh embeds the seeds. The name, *pepo*, is given by botanists to all such fruits.

The watermelon grows wild in the hottest regions of Africa. Livingstone described the vines as covering vast areas, and the natives feasting on the abundant fruit, which, though small, was not bitter. Size, sweetness, and flavor have all been added by cultivation. Egypt first begun the improvement of the wild watermelon, and thence it has spread through all sunny, warm

regions of the earth. It is able to thrive in semi-desert regions, furnishing a thirst-quenching fruit in summer where other fruits are scarce, and water a luxury.

Watermelon culture in the United States is a great commercial enterprise in Georgia, and neighboring states, which ship their crops to northern markets, and grow all they can eat at home. The negro's natural affinity for "de wata-million smilin' on de vine" is not hard to explain. And his proclivities in the direction of raiding a patch by the light of the moon have been developed against his will and disposition. Much rather would he help himself by day to the fruits that lie there, just as in the equatorial belt of the dark continent they lay to tempt the thirsty to take and eat. Why is Nature's plain invitation to-day hedged about by restrictions? Private ownership makes all the trouble, and puts the taking of a melon on the list of misdemeanors, if not crimes. In spite of this, the people of the sunny South, black as well as white, have little to pay, in money or in labor, for all the watermelons they can eat through the long season. What's more, they get the best, because the sweetest, thinnest-rinded, best-flavored melons do not bear shipping.

Northern gardens have a short-growing season,

but there are quick-growing varieties of watermelons suited to their needs. By starting the seeds in flower pots, or berry baskets, or planting them in inverted sods, the young plants are well along when the time comes to set them in the garden. A great saving of time is thus achieved. Liquid manure or other quick fertilizer forces growth, and good culture does the rest. The best soil is a light, warm, sandy loam.

White-fleshed melons may be sweet and fine-flavored, so may the yellow-fleshed varieties. But the American taste prefers a red-fleshed watermelon, with black seeds, and not too many of them — all in a thin, but strong, protecting rind, preferably dark green.

California is a great state for watermelons, because of the intense heat of some interior valleys, and the warm climate of all the lower half of the state. The earliest crop comes to market from inland in June. July and August have the heaviest yield. An acre produces, on an average, a carload of marketable melons. This means one hundred dozen. They run up to one hundred pounds and over; a twenty-pound melon is considered the smallest size to sell. Smaller ones would grade the whole lot to their level, and that doesn't pay.

The record in size is held by a Georgia melon weighing 134 pounds. California boasts the next one, which weighed 131¾ pounds.

A hard-fleshed, globular watermelon with little sweetness is the so-called "citron," whose thick flesh is used for making sweet pickles and other preserves. It has no relation to the true citron we get in candied form. That is a near relative of the orange.

The muskmelon, or canteloupe, grows wild on the coasts of Guinea, in Central Africa, and in southwestern Asia. The fruit is tasteless, and does not exceed the average lemon in size. Who could see and taste that unpromising pepo, and dream of a Rocky Ford or an Emerald Gem!

Every country with a hot climate, and light, but rich, sandy loam can grow this most delicious of garden products with little trouble. Northern states have a short season, but they grow the best melons and most of them. New Jersey produces one half of the crop grown in the United States. It supplies the great cities of the North Atlantic coast.

The two types of muskmelons grown in this country are the early, short-seasoned, nutmeg melons (with a soft, netted rind), and the long-seasoned, hard-rinded, and furrowed canteloupe,

proper. The names are often used interchangeably. In California, which produces fine melons for home and eastern markets from May to December, the term "canteloupe" is the one in use for all varieties.

The most famous variety in the United States, east and west, is the Rocky Ford, named for a town in Colorado, the centre of the district which produced and distributed this unequalled strain of the old "Netted Gem." Something in the soil and situation of these Colorado melon fields especially fits them to grow the sweetest, richest melons yet placed on the market. The flesh is thick and green, and finely netted outside. One and a half pounds is the average size. This variety exceeds others in yield of marketable fruit in the wonderfully productive melon fields of Colorado and California.

Michigan has a favorite strain of the same old variety. The Osage supplies near and distant markets in the central northern states. The Montreal Market, a Canadian strain, is a favorite in the Northeast, and is grown even in California.

The Cassaba, or pineapple canteloupe, is a large, smooth-skinned, furrowed melon, with rich, creamy flesh, flavored somewhat like a pineapple. The chief distinction of this variety, and the sub-

varieties derived from it in the past few years, is that its season is late, and it bears after other melon crops are gone. The ripe fruit is stored for months and keeps well in transportation to eastern markets for the holiday trade.

In Persia and Turkestan, and all Mediterranean countries, north and south, melons have from the earliest times been a staple article of food for all classes of people. The improvement of the cultivated varieties has produced far more forms than we know in American gardens and markets. The French horticulturists have led in the work of improvement, and French gardeners excel in the production of dessert qualities, in hothouses, melon-pits, and in the field. England has too cool a climate for outdoor melon culture, but raises choice varieties to perfection under glass.

### SQUASHES AND PUMPKINS

Professor Bailey, in his "Lessons with Plants," tells us how to distinguish a pumpkin from a squash at a glance. Look at the stem. Does it flare at the point where it joins the fruit? Is it a ridged and furrowed stem? Then the fruit it bears is a pumpkin. Is the stem soft, spongy, and cylindrical, not enlarged at the junction with the

fruit? These are the characteristics of the stem of a squash. Such stems have the Hubbard and turban varieties. The large cheese pumpkin, Japanese pumpkins, and the cushaws show this flare. But the sweet, summer pumpkin does not. Its hard, ridged stem is the tell-tale pumpkin trademark.

The only disconcerting feature of this convenient classification is the fact that the crookneck and patty-pan squashes line up among the pumpkins, and the big Chili pumpkins are squashes!

So when we make a pumpkin pie it may turn out to be a squash pie, judged by strictly botanical standards. By any name it is good enough for hungry Americans in the middle of a hard day's work, corn-husking in the fall of the year. On the Thanksgiving dinner table no distinction is made between pumpkin and squash pie.

But the botanist has the best of the argument at last, because the group he calls pumpkins may be planted alongside of squashes and they will not intercross, as do the varieties within the two groups.

"Gourd" is the European name for all the pepo fruits. "Pumpkin" is the name given to the huge varieties. The English "marrows" we know as

summer squashes, the soft-fleshed, delicately flavored members of the group.

In California all kinds of squashes and pumpkins grow to large size. Single specimens have been exhibited that weighed over 300 pounds, and accredited yields have gone above thirty tons to the acre in an ordinary season. Fifty feet of vine and a wagonload of fruit will be the yield of a well-tilled vine.

Professor Wickson, dean of the State College of Agriculture, has published the following report received from a farmer in Santa Barbara County, and thereby he vouches for the truth of the story:

"I planted my squashes in May, and harvested them in October. Finding that they were unusually large, I weighed ten of the largest and found that their aggregate weight was one ton and fifty odd pounds, the largest weighing 225 pounds. This squash was exhibited at the county fair, and received the first prize.

On the fifteenth of October, which was my boy's sixteenth birthday, I cut open one of the other squashes that weighed 210 pounds, and took out the seeds. My boy then got into it, and I put the piece in place, completely closing him in. I then persuaded my eighteen-year-old daughter to get

into it, and I closed her in, in the same manner. My daughter's weight was 110 pounds.

I next put my two seven-year-old boys in at once. I then put my three little girls in at once; they were aged respectively six, four, and two years, their united weight being 116 pounds. I placed the largest child in the bottom and the little ones on top, and then put on the lid. The squash was three feet four inches in length."

The seeds of all the melon tribe contain considerable nutritious substance, but we must go to a far country before we find them used as human food. The Chinese dote upon them, as we do upon peanuts and salted almonds. In a Chinese theatre the stranger is soon conscious of a murmur made of little, crackling sounds. It is the snapping and crunching of dry melon seeds by the men and boys in the pit, whose pockets bulge with them. They would not enjoy the play without these seeds to nibble, as they watch events on the stage.

## OLIVES

The pale green leaves and the gray bark of the olive trees blend with the ashy soil that lies on the slopes of Vesuvius and Ætna. It is amazing that people have courage to plant again the groves that

an eruption of the smouldering volcano may at any moment destroy. It is a wonderful tree that will grow in soil made chiefly of ashes. The olive does this, and grows to huge size and astonishing age, if the fates permit.

Native of Asia Minor, the olive is probably the oldest of all cultivated fruit trees. It is one of the earliest mentioned in the Bible and other ancient writings. The oil-producing plants were not so numerous as now, and oil was a staple product, with many uses.

The Mediterranean countries cultivated the olive tree when the Aryan peoples migrated westward. North Africa, Australia, and now the great Southwest in our own country are olive-growing regions that ship the oil and the fruit to parts of the world too cold for the trees to grow.

France and Spain and Italy produce much of the oil sent to America, but no better oil is made than that which California sends to market. We need a few years more to learn this important fact, for we still cling to the idea that things "imported" are better than home products. Slowly we are getting over this foolish notion.

When the olives drop from a branch that is shaken, it is time to pick them, even though they be hard and green, if pickled green olives are to be

made. If they are to be pickled ripe, or pressed for oil, they are left until ripe, but not so long that they turn black and soften. If picked too early, the oil tastes bitter; if too late, it is rancid. So the picking must be carefully timed. Then, it must be done by hand, and the fruit cleaned of any spoiled or shrivelled specimens.

The idea of eating fresh fruits off of the trees will do in the case of oranges and grapefruit in California, but olives, green or ripe, are bitter and utterly distasteful in the natural state.

To pickle green olives, the workers soak them in weak lye to take out the bitter taste, then rinse and soak in brine, with certain aromatic flavorings.

The better method is to pickle the fruit ripe, but this process is far more difficult. The same processes are necessary, but they take longer time, and the softening and discoloration of the fruit must be guarded against. The nutty flavor of the ripe olive, and its oily content, make it one of the most nutritious and agreeable of foods. The green olive is an appetizer, and that is about all one can claim for it.

The extracting of oil from olives is simple. Any one with a cider press can do it. In this way families supply themselves with oil for salads and for cooking, in various olive-growing communities.

But for commercial oil production, mills are established that handle the yield of entire sections, thus making the crop more profitable for all concerned.

The olives are dried slightly in the sun, or by artificial heat, to make handling easier. Then they are crushed, pits and flesh, to break the cells that contain the oil. Next, the "pomace" is formed into blocks a yard square and three inches thick, called "cheeses," between folds of thick linen crash. Ten cheeses, separated by frames made of wooden slats, are piled one upon another, and a gentle pressure starts the oil to flowing. This is the best. It is called "virgin oil," and generally goes in with the next grade, making the most expensive quality sold.

Before the third pressing, the cakes are broken up in water, cold or hot. The last pressing gets only inferior oil, used for lighting or soap-making.

From the presses the oil flows into settling vats. It is dark in color, and contains impurities that form a sediment. From one vat to another the oil is drawn, until, at the end of four or five months, it is clear yellow, and ready for sealing in bottles or tins.

The Padres brought the olive trees from Spain into Mexico, and California. The "Mission"

olive, planted around the old Franciscan missions, is the variety best known and best liked in California. Wherever the climate is hot and the air dry, olives grow on irrigated land. But a humid climate will not do. So the olive is not a fruit of the Tropics.

## TOMATOES

Your grandmother has told you that in her childhood people grew for mere curiosity a plant that bore red fruits called "love apples." They brought them in when ripe, and set them on the mantelpiece to admire, until a break in the skin, or a soft spot warned of approaching decay. To eat one of these fruits was not thought of. Couldn't one tell by the rank smell of the sappy stems that the plant is poisonous?

If any one had dared to taste one of these little red "apples," he would have found it tasteless, full of seeds and thick, green partitions, one or more, separating the interior into compartments. The botanist who named the wild tomato plant must have tasted the fruit, and found it bad enough, for he gave it the Latin name, Lycopersicum, which means "wolf-peach" — a peach fit only for the meanest of wild beasts, the dread of mankind. He knew the plant belongs to the

Nightshade Family, all poisonous, as well as bitter to the taste.

The beauty of its red berries brought the tomato into gardens. Selection of the biggest berries for seed led to the gradual improvement of the species, and the modification of the typical fruit in form, in size, and in color. The earliest tomatoes were the cherry, currant, and pear; small-fruited varieties resembling the edible fruits for which they were named. Two hundred years ago yellow forms were grown. About the beginning of the nineteenth century certain horticulturists began the improvement of the tomato as a garden vegetable, and through their efforts the host of fine varieties has been developed.

The little cherry variety is worth growing as an ornamental plant, and the cluster-fruited currant tomatoes will cover an unsightly rubbish heap, and make it a thing of beauty along the road. But over the garden wall see the great, smooth "love apples!" The ridged partitions are firm, juicy flesh, and the seeds are scarce and negligible under the thin skin of the best salad fruit in the world! If you like variety, there are white tomatoes, yellow ones, pink-cheeked ones, as delicately tinted as any peach. If red is the only color for you, there are the scarlet and the crimson varieties,

and the deep, purplish ones. The Ponderosas weigh two and three pounds, and measure near twenty inches in circumference. Higher quality is found in varieties of smaller size. Early, mid-season, and late varieties cover the growing season, furnishing material for the canneries, the pickle factories, and the table. Besides salads, which use the tomatoes raw, either whole or sliced, there are soups, stews, and various made dishes that use them. Stewed or baked tomatoes are delicious. The small varieties are used whole in preserves and marmalades. Ketchups and relishes of other sorts are made for winter use from ripe tomatoes. Green ones are made into similar piquant sauces to serve with meats.

The best tomato region has a long-growing season, warm soil, and abundance of sunshine. The soil needs not be very rich, but it must be moist and well-drained. The stems are flexible, and need staking as soon as they begin to bear fruit. The flowers appear early, in clusters at the joints, the little yellow bells soon followed by the berries, that weigh the branches down, and cause the whole plant to sprawl on the ground unless it is tied up to a stiff support.

Tons of tomatoes are grown in fields of the South for shipment to northern markets before local

market gardeners can supply the demand. The price of fresh tomatoes in winter and early spring is high, but gradually goes down as spring brings in the crop from the Carolinas, Virginia, Delaware, and New Jersey, to the New York markets. In the gardens and fields of warm parts of the world, the tomato plants are practically ever-bearing. In colder sections they are sensitive to frost, and are grown as annuals. Tomatoes for Thanksgiving Day salads may be had in the North by pulling up the plants and hanging them in the cellar loaded with their green fruits. These will ripen gradually, and so furnish the fruit long after frost has killed the plants outdoors.

## EGG-PLANTS

The botanist defines a berry as a fleshy pericarp with many seeds. This is not what the horticulturist means, for a berry to him means a little, soft, sweet fruit, without reference to its structure. Botanically speaking, the egg-plant, is a giant berry. With it ranks the potato ball, and the tomato, as well as currants and gooseberries. And blackberries and raspberries are not berries, but aggregate fruits.

The egg-plant is one of the nightshade group,

Thanksgiving Day is almost here!

Olives, green or ripe, are bitter as gall, until pickled

a member of the same genus with the potato. Native of India, it has spread widely in warm countries, and hardy varieties have made possible its culture in regions where the climate is moderately cold, and the growing season short. The little plants are well grown under glass, until the soil is warm enough to insure quick and continuous growth in the garden. The fruit furnishes a most acceptable vegetable food to people who live in desert and semi-arid regions.

The purple, smooth egg-plants grow larger than a man's head, oval, as a rule, though some varieties are elongated to resemble cucumbers. The flesh is white, and waxy, but firm, and darkens on exposure to air. It is usual to slice the fruit after peeling it, and sprinkle salt between the layers; then place a weight upon them to press out the water. Drained of this accumulation of undesirable liquid, the slices are ready, in an hour, to be dipped in egg, then in cracker crumbs, then fried in butter, peppered lightly, and served hot as may be. Stuffed with a mixture of chopped meat and breadcrumbs, rather highly seasoned, the whole egg-plant is often baked in its skin. The filling seasons the rather insipid flesh, and absorbs its excess moisture.

One plant yields a dozen fruits in the South.

In the North, half that number will be a fair yield before frost cuts short the season. The little fruits are edible, but rather peppery, compared with large ones. The market sizes range about as muskmelons do.

The egg-plant produces its fruit even though failure of the blossoms to be pollenated results in seedless forms. From the cook's standpoint, this improves the vegetable.

### RED PEPPERS

The big, green "bell peppers" are now as common as any vegetable, and mild enough to make a most agreeable addition to salads. But their ancestors, and some of their near relatives, are hot as fire, due to a bitter juice that is especially strong in the seeds and the tissues to which they are attached. Cutting out the white "cores" removes the burning parts, and the walls of the pods are ready to eat, raw or cooked. They "go with" tomatoes particularly well, each adding a good flavor to the other when stewed together. When ripened, the bell peppers are red and hotter in taste than before, but they are milder still than the little varieties. Peppers seem to be hottest in the smallest kinds. Strangely, it would seem, people

of hot countries like peppery foods. A hot stomach may act as a counter-irritant to the hot climate.

The tiny, slim peppers of Tabasco sauce are the hottest of the hot, cylindrical peppers. One of these furnishes the Cayenne pepper of commerce. The thin, red shell is ground when dry, and used sparingly as a condiment. It is much more wholesome than black pepper.

Chillies, or Chiles, are group names applied to the little, hot peppers so universally used in hot countries to season stews and other savory dishes. One sees strings of these little red fingers hanging up to dry over the entrances to houses and shops in Mexico and the south of Europe. The fiery temperament of the Latin races may demand fiery condiments; or it may be the result of such appetite. We Northerners would not like to spare the dash of red pepper in our salads, the piquant flavor of the fresh red peppers in mixed pickles, nor the mild vegetable developed by plant breeders as large as an apple, and enjoyable eaten out of the hand, like an apple.

Paprika is a red powder made of the dry pods of mild, sweet peppers. It can be used far more freely than the pungent Cayenne.

## CUCUMBERS

The balsam apple and the burr cucumber, that wind their branching tendrils over the shrubby growth of neglected fence rows, along the river banks, and hang their spiny fruits where all can see, are the wild representatives we have of a great botanical family, that has furnished us many useful garden vegetables and fruits. In the Order Cucurbitaceæ, belong melons, pumpkins, squashes, gourds, and cucumbers. Any one would class them together, for all have the distinct form and seed arrangement that the botanists call a *pepo*.

The English gardener classes pumpkin and squash and vegetable marrow under the group name, gourd. This is not the American way. We group all under the name, cucurbits. The members prove their tropical origin by being sensitive to cold, requiring, in northern gardens, to be started in warm quarters, and set in the ground when the weather is warm.

They have another peculiarity: they get a severe check in growth if the roots are disturbed by transplanting. The practice is to start the seeds in bricks of inverted sod, or in soil packed in flower pots or berry boxes. The sod or box can be set in the ground without disturbing the little

plant at all. The earth in the pot, too, can be slipped out and planted.

The cucumber is a native of the East Indies, and has been cultivated in China for three thousand years. One of the staple foods of the peoples of the Far East is boiled cucumbers. Europeans boil them, and also make them into pickles and preserves. The flowers appear in the axils of the leaves, staminate and pistillate separate, but borne on the same plant. The pistillate flowers wither, and the little button under the greenish-yellow corolla develops into the elongated fruit. The rough "gherkin" type of cucumber, grown for pickles, is cut before the faded flower drops from the tip. The choicest sweet pickles, by our standards, are scarcely two inches long, though more commonly we let them grow to twice that length before cutting. The vines go on bearing all summer. For salads, cucumbers are grown almost to mature size.

Ripe cucumbers are indigestible, when eaten raw, and their seeds are hard. The flesh is used for sweet pickles and preserves, as the white inner rind of watermelon is, with lemon peel and spices to give it added flavor.

Cucumber vines spread six or eight feet from the hill, so they must be given enough room, or

they hinder each other by overrunning their neighbors' territory. They must have the sun and air. Then they bear tremendously, unless the ground gets too dry, and the vines burn under the combined heat of sun and winds.

Unusual forms or cucumbers are grown for curiosity. The snake or serpent species is more a melon than a cucumber. It grows three or four feet long, twisting its slender body in and out among the foliage, and finally turning yellow as it ripens. The oldest varieties were three-angled, indicating the fact that the seeds are arranged in long ridges, as we see when slicing any cucumber crosswise.

Lemon cucumbers are globular or slightly oval, and about the size and color of a lemon. In flesh and flavor they are very delicate. The California gardener brings them to your door, and they grow to perfection in gardens outside of New York City. So they may be had by us in most any warm temperate region. They lend a pleasant variety to garden cucumbers, and, having so little green in the skins, they lack the bitter taste that ordinary cucumbers have. We must believe that they are more digestible than the green ones. As a salad vegetable this variety is especially welcomed by all who are devoted to cucumbers, but must eat

them sparingly, if not count them forbidden fruit.

"Gherkin" is a name applied popularly to any small, pickling cucumber. The original gherkin is a native of Jamaica, largely grown in the West Indies for pickles, and to be eaten boiled. The vines are very prolific, and the long-stemmed, oval fruits, about two inches long, are streaked green and white until ripe, when they turn yellow. They are covered with fleshy spines, and full of seeds.

# Beverage Plants

## CHAPTER VIII

### Cacao

If a census could be taken of all hungry children to-day, and they could have "just what they want" to cure what ails them, the order for chocolate would be bigger than for any other on the list. Here is a candy that is a nutritious food, too. It has not the objectionable features of most candies, if good grades are bought. A generation ago, children had never heard of chocolate, and very little came to America. To illustrate how suddenly chocolate and cocoa have come in: the imports increased 70 per cent. between 1901 and 1905, amounting to 70,000,000 pounds annually at the time of the last census. European countries are quite as fond of chocolate as the United States. Hamburg is the greatest port and distributing centre for this article. Havre is second. The Dutch are great chocolate and cocoa manufacturers and consumers. So are the Swiss. Much of our importation is from these countries, as the labels tell us. The raw

materials for our own factories come chiefly from Trinidad.

The cacao is a small tropical tree whose hard seeds furnish the cocoa and chocolate of commerce. "Cocoa" is merely a misspelling of the Spanish name of the tree. When the botanist, Linnæus, was called upon to give the tree a scientific name, he sampled its fruit in the form of a cup of hot chocolate. So happy it made the great man to know that any tree could produce so delicious a beverage, he did not hesitate a moment. He called it "Theobroma," which means "food of the gods." By that name botanists all call the cacao trees.

Off in the river bottoms of parts of Central and South America, the Theobroma grows wild. The trees are also found in rank forests in British Guiana, under Dutch rule called Demarara.

When the Spanish explorers came to Mexico first they found the natives growing plantations of cacao trees they had transplanted from the wilds. From that day the cultivation of the tree has spread to the tropics of all countries.

The traveller who visits the cacao plantations notes with surprise that the cultivated trees do not differ from the wild ones; that new orchards are grown from seed, or from little trees dug out

of the woods. The idea of improving the stock by selection, and multiplying varieties by grafting and budding in nurseries, has not yet been put into practice. The cacao industry is waiting for northern scientific minds to work out these problems.

The most important fact so far discovered by growers of the tree is that, though it is almost universal to see the plantations on moist ground, the trees do far better on upland soil. It requires care to make the little trees comfortable when first transplanted. They must be watered and shaded by taller plants for a time.

The native planters learned long ago that pod-bearing plants are best as "nurse trees" to the cacaos. They did not know why. We know that only the plants of the pod-bearing family gather nitrogen from the air and store it in nodules on the roots. When the tops die, the stored nitrogen is given to the soil by the slow decay of the roots. So the leguminous nurse trees first protect the cacaos from sun and wind, but afterward they feed them.

The cacao grows to thirty feet in height, and reaches the end of its bearing period at about thirty-six years. Four-year-old trees begin to bear. The fruit is a rough, red, yellow, or brown

pod, six inches to a foot long, tapering at each end. Inside the rind is a pulpy mass in which are embedded twenty to thirty-five hard seeds, clustered somewhat as watermelon seeds are, at the centre of the pod. The seeds are the useful parts.

Gathering the cacao pods is particular business, and must be done by hand. They grow out of the main trunk, and out of the big branches, a very strange arrangement it seems to those who are used to seeing oranges and apples borne on the slender branches of the trees. In cutting the pods from the trunk one must avoid cutting the encircling buds that are set close to the stem of each. New pods come from these buds. A single fruit follows each cluster of blossoms.

The best way to proceed is to open the pods at once after they are gathered, and put the beans in a box that slowly revolves, so as to give them uniform treatment, without loss of heat during the days they ferment, and lose their bitter principle. A week usually suffices.

The seeds are washed clean, then graded by sizes for even roasting in rotating, heated drums. The beans while roasting lose their bitter taste, their starch is converted into dextrin, and the familiar aroma of cocoa is developed. Next, the thin hulls are easily loosened by a gentle, rolling press-

ure, for heat has made them brittle. A winnowing process separates them, leaving the solid meats, now called "cocoa nibs." They break easily; indeed there is no way to prevent them from breaking while the hulls are being removed. We can buy cocoa as nibs in grocery stores. Some people make cocoa by boiling these. Others are better pleased with the ground beans; the nibs make a beverage too rich for their taste. The difference is this: The nibs contain cocoa oil; it constitutes 50 per cent. of the substance of them.

In the manufacture of cocoa, the nibs are ground fine, and the mass is subjected to great pressure. The fat oozes out and hardens into yellowish cocoa butter. What is left is a cake of brown substance, which again goes through the grinders, and is ready to be boxed and labelled for sale. This is the unsweetened cocoa we buy.

The cocoa butter extracted turns white in course of time, but it keeps without becoming rancid; so it is used in making ointments and salves that druggists keep for sale.

One objection to the manufactured cocoa is that it is frequently adulterated with cheap starch like Brazilian arrowroot. Only the reputation of good manufacturers can defend the public from

impositions like this. The same is true of chocolate manufacturers.

In making a cup of cocoa, the cook usually adds sugar. In making chocolate, she does not. Chocolate is a richer beverage than cocoa. The reason is clear once we know how both are made. Cocoa contains all there is in the nibs except the fat, and it should contain nothing more. To make chocolate, the manufacturer grinds the nibs to a fine powder, adds a certain amount of sugar, flavors with vanilla, and mixes these ingredients into a paste, which is moulded into the tablets and cakes we buy. For cooking purposes, some brands of chocolate are unsweetened. But the fat is in all grades. Rich as chocolates are, they are poor stuff if the makers have used glucose for sugar and imitation vanilla extract, with a generous amount of cheap starch taking the place of the cocoa they pretend to use. The cheap chocolates are lacking not only in nutritiousness but in the good flavor of the genuine.

The shells that are removed from the nibs are not utterly worthless. The drug, *theobromine*, is extracted from them, as well as from the beans, and they are also used as food for cattle. They contain elements that enrich the soil, therefore they are dug in as fertilizer in orchards of cacao trees.

Opening the pods to take out the cocoa beans, from which cocoa and chocolate are made

The sweet water of this century plant is good to drink, even before it ferments

## TEA

The American man who goes to London for a short stay knows that the late afternoon is not the time to do business with a Briton. One important engagement calls people of high and low degree — they must go and get their tea. You cannot stay the universal impulse with any protest that your time is limited and your errand urgent. Nothing takes precedence of afternoon tea. The clerks go, and you cannot get waited on in the shops. Every business is shorthanded for the time except the places where tea is served. They are crowded. An army of servants move swiftly forward to save the lives of famishing fellow-countrymen, bearing pots of tea and hot water, with little cakes, and thin slices of buttered bread. Before six o'clock the hum of industry is resumed. The man of business is ready to see you. The world is a good place to live in, for everybody is fortified by his tea.

Pretty much the same the traveller finds in other European cities, where the British tourist has impressed upon the inn-keepers the necessity for afternoon tea service of the kind rigidly his own. English tea rooms attract Americans, who readily fall into the tea habit. We wonder how

soon, if ever, the business men of America will take to tea-drinking in the late afternoon.

Great Britain is the nation of tea-drinkers. The colonies follow the mother country, and where the Englishman goes into the wilds, he carries his tea-pot and a supply of the dried leaf. The tea consumed in Australasia averages over seven pounds a year for every man, woman, and child! England herself does not come up to this record. The whole United Kingdom averages a little over six pounds per capita. The United States consumes one and a third pounds. With us, coffee is the breakfast beverage. In the British possessions it is breakfast tea, first, last, and all the time. Tea again in the afternoon, and coffee at the end of dinner — for the stomach's sake!

The tea plant is a shrub that may grow to the height of thirty feet, if left to its own way. The leaves are leathery and tapering, with saw-toothed edges, varying greatly in size on the same twig. The flowers vary in color from white to deep rose, their waxy petals and central bunch of yellow stamens making them look like single wild roses. The seeds are usually three, a single one being borne in each of three cells of the dry capsule.

A near relative of the camellia, the tea plant deserves to be cultivated for its bloom and its

beautiful foliage. It requires a climate that is at least warm temperate, so it is not hardy north of our Gulf states. In these it is by no means an uncommon plant.

The leaf is the only commercial product of the tea plant. For this it has been cultivated for five thousand years, if we can believe the ancient Chinese, writings that make mention of it. Until 500 A. D., tea leaves were used as a medicine only. Then tea became a beverage, and sprang into popularity in the Orient.

In Assam, a province of India that borders on China, a species of tea has been found growing wild, and botanists have considered this fact as evidence that this is the ancestral home of the plant. Tradition says that China is its home. Nobody can prove either claim. The interesting fact is that from the wild tea have sprung varieties that thrive in all tropical countries, and the industry based on tea culture is one of the most important in the commercial world.

America, which is not a good customer of the tea merchant, buys each year over four million pounds from Japan alone. Fifteen million dollars a year we spend for tea in oriental markets. And we are not obliged to buy abroad either, for tea from South Carolina plantations is now to be had.

*Farmers' Bulletin No. 301*, of the Department of Agriculture at Washington tells all about this. Write for George F. Mitchell's report on "Home-grown Tea," stating the number of the bulletin as above, and it will be sent you free.

Very amusing are the accounts of the early attempts to introduce to a skeptical public the plants we now use so commonly that we assume they have always been used. China taught the other Eastern countries to drink tea. Tradition says that in the days of "good Queen Bess" a package of tea was sent to an old couple in England by their son who was a sailor, and saw much of the world. They brewed the tea as he told them to, but threw away the brown liquid, and ate the leaves spread on their bread! About the middle of the seventeenth century a tea house was opened in London, but the new beverage was expensive and did not come into general use until many years later, when British India began to send home tea grown in her own tea gardens. The beginning of this great enterprise dates at the year 1840. The contest between India and China, the two great rivals for the tea trade of civilized countries, has been going on ever since, and the British growers have beaten their competitors. But China has a big home market, and Asiatic countries

deal largely with their neighbor on the east. And the demand for tea is growing in all countries except the United States where it is falling off.

The tea seed is started in a special seed bed, and the little plants set out irrigated in nursery rows that are well tended, and sheltered from the sun. When about a foot high they are transplanted and cultivated until they are three years old. Then they are well covered with young leaf shoots called "flush," and the first picking is done. As the branches lengthen, pruning is needed to induce the sprouting of new leafy shoots. This "flush" is constantly renewed, and the bearing of flowers is discouraged.

The plucking is hand-work of a very particular kind. It is an open question whether or not tea can be profitably raised in the Southern States, where labor costs so much more than in China and India and Ceylon. There coolie labor costs very little. Tea growing is practicable in this country. But tea harvesting may be impracticable.

If one could only be sure he is getting what he pays for, he might be more interested in the following classification and names of brands used in Ceylon. The three leaves nearest the tip of the shoots make the "pekoe" teas. The larger leaves

below make "souchong," and then "congou" teas. The tip leaf, smallest of all, makes "flowery pekoe"; the second leaf, "orange pekoe"; the third, just "pekoe." A mixture of this size with the next makes "pekoe-souchong" tea. The younger the leaf and smaller, the more delicate and expensive the tea.

Green tea and black tea are differently made. All tea leaves may be made into either, though some varieties are more easily converted into black than others. And green teas are made from leaves grown in cooler climates, while black teas are the more common product of the warmer regions where tea is grown. Some regions make both kinds.

Green tea is made by rolling the leaves and then drying them. Rolling breaks the cells that contain the refreshing, stimulating principle, *theine*, and the astringent acid, *tannin*, that gives flavor to the beverage. Without the process, the flavor would remain locked up in the leaf cells. The rolling allows the oil to spread over the leaf as it dries. Green tea which is laid out in the open air after the rolling process until a fermenting and oxidizing process takes place changes to a dark color, from which it later takes the name, "black tea."

Different countries have their own methods of curing tea. They involve much special knowledge and skill, much use of the hands and sometimes the feet! This course of moulding, rolling, treading, and firing is a secret in some parts of China. But the essential processes are known, and machinery has been substituted for coolie labor in some places. The product so pleases the tea experts that more modern methods will surely supersede the time-honored, primitive ones.

Green tea is distrusted because coloring matter is often used to give it a more attractive appearance. Since the American trade demands a green tea, and does not exclude, by law, teas containing injurious dyes, we can hardly blame the shrewd manufacturers for catering to our taste.

## COFFEE

The coffee shrub is grown in sections of all tropical countries, producing yearly for the markets of the world 1,500,000,000 pounds of the beans. Brazil raises three fourths of this crop. The United States consumes one half of the world's coffee crop. This astonishing demand places the average for each man, woman, and child in the country between eleven and twelve pounds. Great Britain consumes less than one pound per

capita. So we are the great coffee-drinkers of the globe, as the English are the great tea-drinkers. Only Norway, Sweden, and Holland are addicted to the coffee habit to the extent that we Americans are. Germany has a coffee average equal to England's consumption of tea.

Much tea is grown in little gardens. Coffee is grown on plantations of considerable extent. More than fifty thousand of these estates are the producers of the coffee crop, all employing cheap native labor, and using more or less modern methods and machinery in growing and preparing the crop for market.

The best coffee regions have an even temperature, far cooler than the tropics at sea level, and abundant rainfall. The right climatic conditions are best found on hills or mountain sides of about two thousand feet elevation. The altitude ranges, however, from one thousand to twenty-five hundred feet. The thermometer must not fall below 60° F., and the soil must be rich and deep, with much humus, to hold moisture and to prevent washing when the hard rains come. Virgin forests are cleared for coffee. In spite of the labor of getting trees off, the soil is rich and free from weeds, and such new plantations justify the hard work of clearing.

Now we come to the plant itself, with some curiosity, for few of us who read about it have ever seen it growing, or ever expect to. Ride up to one of the coffee plantations that covers the hillsides in Brazil or Porto Rico, and the courteous owner will send some competent person to show you around. He is pleased if you express a wish to see the industry of coffee-growing from the beginning.

The seed bed is in a sheltered corner, with screens to keep both sun and wind from the plants that come up after the sowing of seeds. If the first whorl of leaves is showing, the plants are being reset in the nursery, where they have six inches of space around each one, and the most careful weeding, shading, and protection from winds. As the stems lengthen, the plants are gradually hardened by leaving off the artificial shade, and when the fourth leaf whorl is developed, the plant is lifted, with all the undisturbed earth the spade can carry, and set in its place in the field.

Coffee plants are perennials, of course. They have woody stems that branch into a round shrub form, and glossy leaves that come out in pairs along the straight, slender twigs, like leaflets on a walnut tree.

The beauty of these little trees you will remark as they stand under the shade of the nurse trees, with which young orchards are usually set. But wait till you go over into a tract of three-year-old plants. The white flowers shine like stars, and breathe a sweet fragrance. They appear at the axils of the leaves, where they are not at all numerous, but quite large. This is their first bloom. Three times a year, from this time forward, the plant blooms, the flowers followed by fruit that takes eight months to mature. This is why the older bushes have both flowers and fruit in the same cluster, apparently.

Light crops are borne by coffee plants up to the sixth year, when the normal habit of bearing is reached, and a pound of dried berries are expected as the yield of the average tree. The berries ripen unevenly, so the crop is picked by hand, and very carefully, so as not to injure the berries that are coming on. The harvest time lasts four months. The picking costs $1.20 to $1.40 per hundredweight of berries in Porto Rico. Whole families turn into the fields at the coffee harvest, and it is as jolly a season as cotton-picking time in the Southern States, and the hop-gathering in New York State. The West Indian negro works for the munificent sum of

35 cents to 50 cents a day, and boys get from 10 cents up!

The fruits of the coffee plant are at first green, then yellow, then red. At this stage they are full grown and look just like cherries. These "cherries" are not good to eat, though they are fleshy and red. As they change to dark wine color they are ready to pick.

The fruit contains two hard little seeds, each flattened on the side that lies next to the other. Each seed has a dry, yellow hull that fits it closely, and a filmy inner lining of this horny "parchment," known in the coffee industry as the "silver skin."

When one of the beans fails to "fill," the single seed remaining takes up all the room, grows to unusual size, and is not flattened. These seeds are carefully culled out of the company of the flat berries, and sold at a higher price under the trade name, "pea-berries." Another round seed is the berry that grows alone at the tip of each twig. It is smaller than the paired beans, and is sorted out and sold under the trade name, Mocha.

This name is borrowed from a variety with small grains and very fine flavor, the best Arabian coffee, which never gets into the American market at all. Indeed, all the coffee raised in Arabia is called Mocha, and buyers from Egypt and Tur-

key go into the plantations and buy the crop on the trees. Only the inferior coffee that these buyers refuse gets to the port of Mocha, and thence into the market. So the trade name, Mocha and Java, is misleading in the extreme. We might as well understand that the first name would better be dropped.

Java coffee comes from the Dutch East Indies, where the plantations are under government control, and methods are very thorough. The Arabian species was at first grown. But unfortunately a leaf disease destroyed the industry by killing the trees. The coarser Liberian coffee was introduced and found to be resistant to the blight. Nothing could be done but grow this less desirable, but more vigorous and productive species. Since the leaf disease swept the Islands in 1873 and again in 1878, the cultivation of Arabian coffee has been attempted only by private enterprise, and for household use by families who are willing to take the trouble and the risk for the chance of having the rare, fine Mocha toasted, pulverized, and steeped as a morning beverage, just as their forefathers had it in the good old days.

Special high quality is accorded by experts to coffee raised in Bolivia. But the home market consumes it all, so we cannot test it. "Blue

Mountain" coffee, grown at high elevations in Jamaica, commands the highest prices paid anywhere. This is a very small crop, absorbed by a very special trade. Mexico is growing coffee that is cheap, as it competes for a place in popular esteem. Hawaii is an ideal coffee country, and growers are clamoring for protection that will enable the industry to get on its feet. They produce a large, mild, but high-flavored berry, at a cost of about 9 cents per pound.

The cherries are treated by the *wet* or *dry process* to free the beans. They may be "pulped" by running through a mill that scrapes off the flesh, then allowed to soak and ferment a day or so to rot away the slimy substance that would not come off in the pulping process.

After thorough washing (formerly by trampling the submerged berries with bare feet, now by agitating them mechanically), the water is drawn off, and a number of rinsings clear away the scum, and leave the berries to dry in their bright parchment hulls. As rain and dew would retard the drying, the plan is to cover the berries when the sun is gone. Sliding roofs or sliding platforms, that may be shoved under cover, protect the drying berries. Artificial heat is sometimes used.

Next, the berries may be sacked for shipment,

or they may be put through the hulling machine, that removes the horny covering. This is the "peeling" process. The winnowing blows away the broken hulls and the silver skins that are rubbed off, leaving the coffee bean as it comes to us in the unroasted state.

The *dry process* takes the berries from the pickers' baskets, spreads them to dry on stone floors, where they are raked over to make sure all are dry before they are stored away. When needed, they are freed by pounding from the coat of dried flesh and parchment which are like a single layer. A hulling machine does the work quickly, and is generally taking the place of the simple mortars.

The final preparation of coffee berries for market is the sifting out of broken grains, and grading into different sizes. This is done by the use of sieves of different sized mesh.

Before using, the berries are roasted till they turn dark brown, then ground or pulverized. The hot water extracts the caffeine and a volatile oil in which resides the flavor of coffee. The stimulating and refeshing effect of the caffeine is harmful to some people, and probably to all who drink much of this beverage. We must not forget that coffee is a much-abused article of commerce. It is subject to gross adulteration, and

even the pure coffee becomes unfit for drinking if boiled a long time. Boiling brings out an increasing quantity of the caffeine, which is injurious to the nervous system.

## MATÉ, OR PARAGUAY TEA

Tea-drinking of an entirely new kind the traveller meets in the lower half of South America. At first the bitter taste, and the unfamiliar aromatic taste, of the universal beverage of the people are not at all to his liking. But if he sets his mind to it, a liking for the "yerba de maté" grows on him. He takes it with pleasure after hours of exercise, and finds his drooping spirits revived, his tired feeling gone.

The plant whose leaves are used in making this beverage is a holly that grows as the principal species in vast forests in Paraguay and neighboring countries. A few plantations of the tree have been set, anticipating a possible exhaustion of the native supply. The branches are gathered and dried over fires. Then the leaves are beaten off and broken or ground into a coarse powder. The highest market grade of the dried herb comes from the youngest leaves. The cheapest grade has twigs and leaf stems in it.

Maté is brewed by pouring hot water over a pinch of the tea leaves held in the bottom of the cup by a disk of wire netting to keep the liquid clear of "grounds." Sugar is added. The tea is drunk through a tube used as we do a straw for lemonade. But there is a perforated bulb at the base of the tube that strains the tea.

### PULQUÉ, THE BEVERAGE OF MEXICO

The century plant is our most familiar plant of the Agave tribe. In the dry air of the highlands of Mexico these fleshy-leaved, robust plants seem to draw water from unknown sources, and store it in their bodies. The Mexican digs a hollow in the central stem, usually by cutting off the flower stalk, and goes away. He returns soon to dip out the accumulation of sweet sap, which he calls "agua miel," sweet water. This is good to drink. But after it ferments he likes it better. It is then the bad-smelling, good-tasting pulqué the universal beverage of the people. Foreigners object to the odor of spoiling meat. But even this does not long keep them from tasting, and really liking, the drink, which can be had in various stages of fermentation.

# Narcotic Plants

# CHAPTER IX

## TOBACCO

When Benzoni, a Spanish explorer, wrote of his travels in Mexico, about the middle of the sixteenth century, he described plantations of an herb the natives called "tabacco," the leaf of which was dried and smoked in a pipe. Earlier in the same century, the islands off to the southeast of Florida were explored by the followers of Columbus, and here tobacco was seen first by civilized men. The natives dried the leaves, then made a little bonfire of them in an open vessel, and sat down before it to inhale the smoke, which gave them a pleasant sensation of physical comfort. The tool they used was a hollow tube that branched near one end. One arm of the Y was inserted in each nostril, and the other end of the "pipe" was held where it caught the smoke, close to the smouldering leaves.

The North American Indians used a pipe much like those we see to-day, and inhaled the smoke through the mouth. The Y-shaped pipe, first

seen on the island of San Domingo, was called "tabaco." So there is little doubt that this funny little nose-pipe gave its name to the plant, which has spread from its native land, America, to the principal countries of the Old World.

Of course the Spaniards tried the novelty, and soon learned to like the taste and smell of the narcotic plant. They introduced it in Spain, and the French ambassador to Spain took a plant home with him, and presented it to the king and queen. Other plants were sent by him to set out in the royal gardens in Paris, where the great reputation of the newcomer rested on its medicinal properties. Famous Spanish physicians had hailed the tobacco plant as a cure for many diseases, and it was called "the holy herb," and "herba panacea," the cure-all.

The name of Nicot, the ambassador to Spain, was given to the tobacco plant by the botanist Linnæus, who named it *Nicotiana Tabacum*. The drug, nicotine, contained in the sap of the whole plant, is very poisonous. It must be remembered that tobacco belongs in the Nightshade Family, which has a number of poisonous plants in it.

Fifty different plants of the genus Nicotiana are known. The tobacco of the world comes chiefly

from varieties of the single species, which was carried from America to Europe, and thence spread to the other parts of the world where the plant is a commercial crop. Some of the best of foreign tobaccos are from seed of varieties developed in sections of the United States.

Tobacco is a tall, broad-leaved plant, with a central stalk that bears, at maturity, a branching, loose cluster of pink or rose-colored flowers, with funnel-shaped corollas, each drawn out into five points. The seeds are so small that a great number are packed into the pod that matures in the clasping, green calyx at the base of the funnel. An ounce contains over 300,000 seeds! But a small proportion of them are able to sprout, and those which are "viable" have such hard shells that the little plants have the hardest work to get out. It is a common practice to rub the seeds gently in the hands with powdered emery to bruise the coat and thus ease the sprouting process.

The seedlings are raised in a specially prepared seed bed, and transplanted to the field when about four to six inches high. They are set, by good growers, three or four feet apart, so that the cultivator can run through between the rows in both directions. Clean culture, but shallow, kills the weeds and saves the soil moisture for the feeding

roots. When the top is about to blossom it is removed to throw the energies of the plant into leaf-making. Side shoots are removed as they appear, for the same reason. When the leaves are sticky, and show yellow when held before the sun, they are ready to harvest. They break easily when bent.

Harvesting methods differ, but the operations include cutting, drying, sweating, and packing the leaves. Kentucky harvests a tremendous crop, the biggest of all the tobacco states. Wisconsin and Massachusetts are the northernmost tobacco states. Florida grows special grades of fine, tobacco. So does Connecticut. Louisiana grows a famous kind.

The great tobacco producing countries of Europe are Germany, Russia, and Hungary. India, Samatra and Java, Turkey, Japan and China are the Asiatic countries. Cuba and Porto Rico, Mexico and Argentina are the tropical American tobacco regions, and Argentina and Brazil are great tobacco countries in the South Temperate Zone. The industry is growing in Africa and the Philippines. A million tons are sent to market yearly from all the plantations of the world.

The quieting of nerves, and a general feeling of

bodily comfort are the benefits enjoyed by the smoker of tobacco. The nicotine, he claims, is dissipated in the burning of the tobacco, but he concedes that other poisons are developed in the smoke. The damage to the heart and other organs of some smokers is traceable directly to the narcotic of tobacco. Nerves of other people are worn to a state of prostration. Because the effects of tobacco are not alike in different people, the user of the "weed" is very likely to blame the bread he eats, as soon as the pipe he smokes, for ill health. All agree that the moderate smoker is far better off than the immoderate one. And there are no two sides to the question of the injury boys suffer from the use of tobacco.

Chewing tobacco and snuff-taking were habits learned by the early Spanish explorers from Indians in the West Indies and South America. Snuff is a compound of powdered tobacco, which is inhaled, a pinch at a time, for the "titillating joy" it gives the lining membrane of the nose. The snuff-taking of the aristocrats of the eighteenth century was a dainty performance. Snuff-dipping as practised now by the "cracker" of the South is disgusting. And the sources of the material out of which cheap snuff is made are unspeakable. Chewing tobacco is a habit no one

can practise to-day and retain his self-respect. It is not tolerated in respectable society in this country, which demands that a gentleman smoke his tobacco, or go without it.

### POPPY

The drug, morphine, is extracted from the dried juice, called opium, of the poppy, cultivated extensively in eastern countries. The pod that contains the seeds is pierced while still green, and the milky juice that exudes is allowed to dry overnight, when it is collected. Hand labor makes poppy culture a slow, primitive business. But the Indian government has built up a vast industry through its monopoly of the growing of this plant and the export of opium to China. The Chinese are opium-eaters (or smokers) to such a degree that their rulers have become frightened, and have tried to stop the importation of the drug, in hope of checking the habit. The British and the local officials have worked against the success of this wise plan, causing repeated failures, until recent years. Now the importation of opium is lessened, and China is throwing off the deadly drug.

The effect of opium is first exciting, then drowsiness ensues. Small doses ease pain, and give a

sense of comfort. Big doses produce deep sleep, then coma and death. Opium-eaters are slaves to a terrible habit they cannot break. They are useless to themselves and to their fellows.

Morphine is used by physicians to allay acute suffering and to bring sleep when natural sleep is impossible. They use it with extreme caution and sparingly, as a last resort, knowing the danger. It is administered through the mouth or by means of the hypodermic needle directly into the blood.

Codein is another drug derived from opium. It produces effects like those of morphine, but it is not so powerful.

## BETEL NUTS

The natives of the Malay Peninsula and neighboring islands are addicted to the habit of chewing betel nuts, the seeds of the Areca palm. The fruit is the size of a hen's egg. Inside the fibrous husk is the nut, which is sliced and wrapped in the leaves of a peppery plant. The saliva of the chewer turns red and flows freely, owing to the hot and bitter taste of the substance. The effect is at first stimulating, then stupefying to the senses. Moreover, the habit is one that cannot be thrown off. The teeth gradually turn black, and decay.

Often a victim of this practice is toothless at twenty-five years from it. Ceylon exports half a million dollars' worth of these nuts annually.

The gum-chewing habit seen so much in this country is less defensible among our intelligent people than the betel-chewing of the dark-skinned natives of the East Indies. They have less knowledge of the proper care of a healthy body, and no higher standards to judge their habits by than those inherited from half-civilized parents

## COCA

A wonderful power of resisting mental or bodily weariness is imparted to the person who chews the leaves of the coca shrub, that grows wild in the Andean valleys of Bolivia and Peru. The dried leaves, mixed with quicklime, are chewed by all the natives of the region, and quantities are exported, for it is from these leaves that the drug, cocaine, is extracted. This is used in dentistry, to produce insensibility to pain over a small area, and for a short time. The habit of chewing coca leaves is an ancient one. The Indians cannot get on without this stimulating drug. The habit of taking cocaine is a recent one among civilized people, and though the results are soothing, the

intoxication being somewhat like that induced by opium, the habit is dangerous in the extreme. Slaves to the coca or cocaine habit are short-lived.

Do not confuse the shrub coca, with the useful coco-nut, a palm, nor the cacao tree, from whose seeds cocoa and chocolate are made.

The Cola, or Kola, is a tropical African tree, whose fleshy nuts, like horse-chestnuts, have much the same effect on the nerves as the leaves of the coca. The two are combined in a summer beverage that physicians condemn, knowing the two drugs it contains, and the billboards extol as harmless and delightful.

# Fibre Plants

# CHAPTER X

## Flax

Flax is the oldest of cultivated fibre plants, and, until the growing of cotton became the great agricultural industry of the South, it was the most important of the world's fibre crops. Only within the last century has flax surrendered first place to cotton, though both plants have furnished clothing to civilized man ever since he began to demand something different from the skins of wild beasts. Cotton has the advantage of being cheaper than flax to raise and to prepare for weaving into cloth.

Wild flax probably grew on the hillsides of Assyria and in the Nile Valley before it was brought into cultivation. Nowhere does it grow in a wild state to-day, unless we count the roadside flax escaped from fields. It was grown and cloth woven of its fibres, in ancient times, as the earliest records prove. The mummies of early Egyptian tombs were wrapped in linen cerements, and the flax plant was carved on the tombs. The Bible describes the royal splendor of kings, clothed in

purple and fine linen. The strength and durability of the fabric, whether coarse or fine, and the snowy whiteness and silky lustre of the cloth when bleached, established flax as the finest fibre crop in the agricultural countries of the world.

The Lake-dwellers of Switzerland, who represent the Stone Age, grew the plant for its fibre, which they wove into cloth. The household industries have brought the growing, spinning, and weaving of flax down to the time when machinery relieved human hands of much of the labor involved. But machines have not made better nor finer linen than the old-time hand looms produced.

A large part of the difference in cost between cotton and linen is due to the fact that machinery has not yet taken much work away from the hand-laborer in linen manufacture. Cotton machinery, from the newly introduced pickers, and the gins, to all the mill machinery, is a perfect system that makes the machinery used in handling flax look crude indeed. And it is crude.

Flax is a delicate, branched plant, two or three feet high, with narrow, long leaves, set opposite, and numerous pale blue flowers, followed by globular capsules, each five-chambered, with two seeds in each chamber. The shiny, slippery, brown seeds are kept by every druggist. They are in

demand to make flaxseed poultices. A single seed dropped into the eye will invariably capture the cinder that no other means has been able to remove. The gum that coats the seed swells when wet so that a poultice takes up four times as much space as the dry seeds did. More commonly, the meal is used, cooked to a mush, and applied as hot as can be borne to painful swellings, which it relieves by keeping moist and warm.

The growing of flax in America to-day is chiefly for its seed; the making of linen from the fibre is not yet profitable. The farmer threshes his flax, and sells the seed to his local grain merchant, who sells it to the jobber, who sends it to the linseed mill. Here the seed is cleaned of weed seeds and refuse by screening and fanning machines; then it passes through a series of rollers that reduce it to a pasty mass of meal. Now the meal is put into camel's hair bags, and moulded into cakes, that are heated to near 200° F., then brought under pressure that extracts the oil, leaving "oil cake."

The oil is drawn off and refined, after which it is ready for market. Oil cake is ground into oil meal, and sold for stock food. "Linseed" oil is used in the manufacture of the best grades of paint, and for a multitude of other purposes, including the making of patent-leather shoes.

The Dakota farmer may sell his flax straw as it comes, broken and tangled, out of the thresher, to the tow mill, where it is made into stuffing for cheap mattresses, upholstered furniture, padding for refrigerator cars and cold storage warehouses, ice boxes and the like, or spun into binding twine. The highest grades of linen made in America at a profit are coarse crash towelling, carpet yarns, and fish seines.

### THE GROWING OF FLAX

Homespun linen clothed our ancestors until they could no longer afford to keep the industry going. Labor is high-priced, so Americans buy their linens abroad, where labor is still cheap. The improvement of machinery to handle flax may soon make it a profitable industry in this country. Students of the problem believe the time is coming when we shall make our own table linens.

The growing of flax is an exacting business. The best soil is a heavy, rich, well-drained loam that has borne crops that require clean culture. This means that the weeds are under control. On this soil, finely mellowed, and lightly rolled, the seed is sown broadcast, by hand, and har-

rowed with a tool of many teeth, to cover. In Europe the field is rolled when the seeds sprout, and when the flax plants are two inches high they get a careful hand-weeding. This work is done by women and boys, who kneel at their work. Sometimes two or three weedings are necessary. The earlier the sowing, the better the fibre, if early frosts do not catch the crop.

"June makes the flax," they say. Then or never the stems lengthen, and the three months of growth end in flowers and seed capsules. When the lower leaves droop, and the pods are turning to yellow, the men go out to pull the flax. Handfuls are pulled up, laid with even roots on the ground, after the dirt is shaken out, and all weeds discarded. Bundle is laid across bundle to let in air. So the field is harvested, and the dry stems prepared for stacking or retting.

The seeds are "in the dough" when the straw is in best condition to make linen. But even these unripe seeds must be removed. Hand labor again. The worker takes a handful at a time, and draws the heads through a rude stationary comb; the capsules roll off as they are drawn through the teeth.

"Retting" is the process that separates the fibre in the bark of the flax stem from the gummy sub-

stance and the woody tissues. It may be done chemically in a short time, but that injures the fabric. "Dew-retting" is laying the straw on the grass and letting the rain and dew rot away the parts that support the soft, strong threads. It takes weeks for this method of retting, and the fibres are stained by uneven contact with the earth and sun.

"Pool-retting" is submerging the bundles of straw in natural or made pools of soft water until the fibres are freed by fermentation.

"River-retting" substitutes running water for stagnant. The most perfect place for this process yet found is a stretch of several miles near Courtrai, in Belgium, in the bed of the River Lys. Its murky waters barely creep along over a bottom of blue clay. Flemish flax-growers draw their heavy loads of straw to the river, pack their crates, and wait their turn to push off these precious loads into the river. Each crate is covered with a protecting layer of rye straw and properly ballasted with stones so that the flax will all be under water. When the process of retting is complete, a crane raises the crate, the straw is spread on the grass till thoroughly dried, then carried away.

Flax retted in the "Golden Lys" is soft and silky, and finer than any retted elsewhere. Just

why, nobody knows with certainty. Pools lined with blue clay do better than others not so lined. It may be that the clay does it.

The dry straw is next broken by passing through corrugated rollers. The result is that bits of woody substance from the stem fall off in the "scutching," or combing, and shaking that follows. Tow is the name given the combings of the scutching tool. Next, the "hackling" does the thorough combing that removes snarls in the fibres, and gets rid of any "shives" (woody particles) the scutching missed. The skeins of flax are ready to be baled and sent to the mills for weaving into cloth, or spinning into yarn.

A single fibre of flax may be over a foot in length. Though one of the finest of fibres, it is stronger than that of any other textile plant. These facts explain the strength and the filmy sheerness we see combined in some handkerchief linens, and their durability.

Nobody can fully appreciate the beauty of the flax flower until he has grown a plot of it. "Blue were her eyes as the fairy flax," wrote the poet of the skipper's little daughter, in "The Wreck of the Hesperus." Our flax flowers are a color we can't forget. We can easily follow the steps by which flax is prepared for spinning, and do by

hand, or with tools we make, the retting, breaking, scutching, and heckling.

Choose the longest fibre in the skein of your own making. Stretch it taut. The English word, "line," originally meant "a thread of flax," whose Latin name is *Linum*. A dozen words come from this old root: the German lein, French lin, Celtic llin, Swiss linie. The English words lint, liniment, linseed are from the same root. I fancy that lin, a pool or brook, came from the use made of these in the retting of flax.

## COTTON

Dixie-land is the land of cotton. Draw a line on the map from the mouth of the James River, at Norfolk, Virginia, west to Cairo, Illinois, and on through Memphis, and Little Rock to Dallas, Texas. Below it lies the region of profitable cotton culture of the United States. "The Cotton Belt" occupies the southeastern quarter of our country, touching the Atlantic and the Gulf, and reaching nearly to the western boundary of Texas. Only the lower half of Florida and the delta of the Mississippi are left out, and they are offset by a cotton region in the new West that centres at the point where Utah, Nevada, and Arizona meet.

"Of the 17,782,440 bales making up the 1904-5 cotton crop of the world, the United States grew 13,420,440 bales." If Mr. C. W. Burkett, author of the great book, "Cotton," is sure of his figures, we see that the United States grew in that year three times as much cotton as all other countries put together. Cotton is the principal crop in ten states of the South. Yet the industry is capable of wonderful expansion, and the next half century will see the cotton yield doubled without extending the territory. Only one acre in seventeen in the Cotton Belt now grows cotton. The average yield is less than two hundred pounds of "lint," or fibre, per acre. Many large cotton plantations, under careful cultivation, average 500 to 800 pounds of lint per acre. The primitive methods of growing cotton must be reformed; then the yield will keep pace with the growing demand for more that comes from the mills and factories. More land can be planted to cotton, when the world needs more than good farming can produce on the present acreage. The supremacy of our country as the producer of cotton will never be taken away. This is the opinion of the best authorities in this and other parts of the world.

The reason we are confident that more cotton will soon be needed is that civilization is opening

doors and entering regions that have until now had no contact with the world outside. Savage peoples are receiving strange visitors from over seas, whether they wish to or not. Africa, the dark continent, and China, with its millions of inhabitants, have been thrown open recently.

"It is estimated that of the world's population of 1,500,000,000, about 500,000,000 regularly wear clothes, about 750,000,000 are partially clothed, and 250,000,000 habitually go almost naked. To clothe the entire population of the world would require to-day 42,000,000 bales of cotton, of 500 pounds each. It therefore seems likely that the cotton industry will go on expanding until the whole of the inhabited earth is clothed with the products of its looms." The cotton experts of the Department of Agriculture at Washington thus reason and predict the need and the means of its fulfilment.

The fibre that clothes the multitudes must not only be strong and soft and flexible; it must be cheap. Cotton is all of these. Cotton imitates the silkiness of silk, the wooliness of wool, the strength and sheen of fine linen. It is all things to all men. We know it in a half a hundred forms in our homes — this useful, beautiful fibre. We wake in the morning, and see the sunrise through

parted curtains of muslin. These and the roller shade at the window are both cotton. The sheets, pillow cases, mattress, and coverlid are cotton. Turkish towels and bath rug are cotton. After our bath we dress in clothes of cotton, if the season permits. In the coldest winters we wear some garments of cotton. Our buttons are sewed on with cotton thread. Through the day we see and use cotton fabrics. Towels, tablecloths, and napkins are of linen, but rarely is it in common use in other ways in our day. It costs too much.

Cotton cloth is prosaic and coarse in the calicoes and muslins of the ordinary kinds. But some of the muslins of India were of cobweb fineness — "webs of woven wind," the poet has called them. The Hindoos two thousand years ago were producing, on their simple looms, fabrics whose fineness cannot be exceeded by the best modern looms. Exquisite cotton fabrics, dyed in many harmonious colors, were sent from Mexico to the Spanish monarch by Cortez, who rifled the treasures of the Aztecs.

The cotton plant belongs to the Mallow Family, along with the hollyhock, hibiscus, althea, okra and the little weed we call "cheeses." The flowers plainly proclaim the relationship of these cousins. The trumpet-like corolla has a belt of

stamens, all grown together by the fleshiness of their filaments that form a cylinder enclosing the pistils. The abutilon, or flowering maple, grown indoors, illustrates well this mallow type of flower. The fruit is a pod, with several compartments containing seeds. In the cotton plant, the seeds are provided with long hairs, as a milkweed seed is. Nature evidently intended these hairs to aid in scattering the seed. The pod bursts open when ripe, and the hairy mass is pushed out by its own expansion. The seeds go wherever the "wool" goes.

In growing cotton, the planting day waits until danger of frost is about past, and yet the planter must beware the early fall frosts that might get his cotton at the other end of the season. Six months of growing weather, warm, with showers enough and plenty of sunshine, the cotton plant requires to do its best.

The seed is put into the ground, in a continuous row, like peas, though single plants two feet apart is the ideal "stand" on good land. The little plants come up slowly, and pretty feeble they are, crowding each other for standing room. When they are a few inches high the strongest begin to assert themselves, and the "choppers" come in with hoes to thin the plants, and destroy, with

other weeds, all plants but the few that are chosen to make the crop.

Next comes the cultivator, with the important duty of stirring the surface soil, thus killing the young weeds and grass. Unhappily, the ignorant cotton-grower goes too deep and too close with his one-horse plow, which cuts off side roots, and so gives the plant a great backset. It is the same plow he used in the preparation of the field for the seed, and is utterly unfit for the tilling of a growing crop. Besides he must make two trips to do a single row.

It is a pathetic sight to see farmers damaging their crop with labor that is so hard, when a tool suited to the job would save half the effort and double the yield of the land.

Every week or ten days the cultivation of the rows is needed to check the weeds and grass, and to keep the soil moisture from being lost by evaporation. The roots are gathering their food from the soil moisture, and need all they can get.

Rains by night and hot sunshine by day bring the cotton plant up fast, send out side branches, heavy with leaves, and on these branches the buds. The flowers open, white or yellowish, and close at nightfall. The second day they open and become reddish. On the third day the blossoms fall,

leaving behind the little pointed bolls with the green calyx to protect each. Gradually the boll grows until it reaches the size of a hen's egg. Then it cracks along three division lines, showing white fibres that hide the seed. In a little while the picker comes to pull the fibrous mass out of the pod, and the story is ended.

Not all of the bolls ripen together on a plant. Indeed, it would be a simple job to invent harvesters for cotton as for corn. But the bolls ripen gradually through a period of three months. The colored race loves the cotton, and furnishes the pickers. Families leave the cities and swarm to the fields, singing the songs of their people, revelling in the freedom and the beauty of the country, while they work (not too hard!) and earn money against the coming of winter. The picking costs two cents per pound of lint. The farmers of the South paid out $75,000,000 for the picking of the cotton crop of 1905!

The pickers' bags are weighed as they are emptied, and the seed cotton goes by the wagon-load to the gin.

The cotton gin is the machine that separates seeds from lint. Until 1792, when Eli Whitney invented this wonderful machine, the seeds had to be picked by hand out of the fibre — a toil-

some, slow process. The gin revolutionized the whole cotton industry of the world. Inventions had just supplied machinery to take the place of hands in the spinning and weaving of cloth. The gin made it possible for the cotton-growers to supply the increased demand for lint. It bridged a chasm about which men had been hopeless.

The gin to-day is an improved machine, compared with Whitney's. But it does the work on the same principle. The freed lint is compressed into bales that may be marketed at once, or kept for sale later.

The best fibre is the longest and finest and strongest one. Sea Island cotton has highest rank. Its fibre averages 1.61 inches in length, and is fine and silky. A pound of these fibres could be spun into a thread 160 miles long! Unfortunately, this variety grows only on the coast of South Carolina, Georgia, and Florida, and the islands of that region. So the amount produced makes little impression upon the market.

The hairy upland cotton, with short fibre, is the common crop of the Cotton Belt. Its "staple" is less than an inch in length, and correspondingly thicker than that of the Sea Island. Of this prevailing species, a number of varieties have been

developed, adapted to different situations, soils, and other conditions.

Attempts have been made to lengthen the fibre by seed selection, cultivation, fertilizing, and by hybridizing. These efforts have already improved the quality of the different varieties, and it is but a short time since they were begun. The future will carry the work forward much more quickly, for the Government experts are teaching the farmers how to use improved methods in all phases of cotton culture.

India has two native species of cotton, one a tree, the other a bush. The latter is the field cotton of India, inferior to our upland species in size of boll and length of staple. Tree cotton is not grown as a field crop anywhere.

Seed cotton is one third lint and two thirds seed. The gin separates the two. The farmer loads his crop into the wagon and drives to the gin. Here a suction elevator conveys the load to the gin, which drops the seed below, and blows the lint away to a receiving place, the lint room, from which the compresses bale it into a dense package, covered and roped for storage or shipment. The modern cotton bale weighs about 500 pounds. Its destiny is the mill, where the lint is spun and woven into cloth.

Until a few years ago the cotton seed was an accumulation of waste, that the gin-owners had trouble to dispose of. They built their gins over streams, so that the current would carry off the seed as it fell. If the cotton seed was treated so to-day the cotton-growers would be losing in a single year $100,000,000 worth of valuable material. Instead, not far from the gin stands the oil mill, and the seed is saved as carefully as the baled lint at the gin. In the market it is worth $16 a ton.

The seed goes first through screens that clean it of bolls, dust, and sand. The next machine is the linter, which strips the seed of the short lint the gin leaves on. This fuzz is used in paper mills. The seeds next pass into the huller, a machine set with knives that chop the seeds fine; the hulls are screened out of the meats which fall, being heavier than the hulls.

The hulls may be stored in bulk as they come out of the huller, or pressed into bales for more convenient handling. The meat fragments are crushed and cooked; then the oil is pressed out, and the residue molded into cakes. These cakes are usually ground before the molding that puts them into the form we see oil cake in use.

The oil goes to the refinery, after separation

from its sediment. Refined, it is ready for use in cooking, as food adulterants, as medicines, and for miners' oil. The oil needs no apology. It is a pity that it has come into use as an imitation of other oils, including butter.

The farmer takes his seed to mill and sells the oil for which he has no need. He keeps the hulls and the meal, which contain the most valuable feed and fertilizer for his cattle and his land. The nitrogen, phosphoric acid, and potash in one ton of cotton seed is worth $12.75. A ton of cotton-seed meal contains the three plant foods named above, in about double the quantity, so that its market value is $25. The farmer who keeps up his farm's fertility must count the cost of commercial fertilizers very carefully. His decision is to bring back the seed, in one form or another, sparing the oil only, for that has no value when it is fed or put upon the land. With constant cropping the land will be impoverished, and the crops constantly poorer, unless feeding the land is practised.

The best form of fertilizers is barnyard manures. The wise farmer raises cattle, feeds them the hulls and meal left after the lint and oil are taken from his cotton crop and sold. The cattle grow, and the milk, butter, and beef are marketed in due time. The manure is spread on the fields, and so

Tobacco is a stately and beautiful plant

Harvest time in the cotton fields

the fertilizers are better prepared to enrich the ground at once than if the seed had been spread, and the crops had to wait until decay released the plant foods.

Cotton has often been grown at a distinct loss, and the people, white and black, are only recently lifting their heads in hope, in the Cotton Belt, realizing that the grower may have the comforts of life as well as the broker and the manufacturer. Wisdom is spreading where ignorance once prevailed to keep the hard-working people in a form of slavery to worn-out methods on worn-out land.

## HEMP

We all know hemp as a roadside weed, tall, straight, with whorls of spreading, lady-finger leaves, all pitching at a downward slant, the flowers clustered at the bases of the leaves, as happens with all members of the stinging nettle family, to which hemp belongs.

Wild hemp, as it grows escaped from cultivation, and in its native region, western Asia, has poor fibre. But in the hemp fields of Russia, Austria, Turkey, Italy, China, Japan, and the United States, it may reach ten, and even twenty feet in height. The fibres of the inner bark, when prop-

erly separated, come out creamy-white, soft, pliable, and with a silky sheen. It is substituted for linen in all but the better grades in the north of Italy, where methods of cultivation and curing produce the best quality of fibre.

The great hemp region of this country is the Blue Grass in Kentucky, where a rich, moist, well-drained loam overlies limestone. The seed is sowed and rolled, but not cultivated after it comes up. The vigorous plants get the start of the weeds and kill them out. The roots plow deep, and the stems soar.

When the flowers appear and the tops turn yellow, then comes the harvest. The stems are cut as low as possible, for the best fibre is at the base. The September sun dries the stalks that lie with butts down hill on the grass. In a week they are gathered into small bundles, tied, shocked, or stacked.

In November the stems are spread for two months so that moisture and frost rot the outer bark and woody centre of the stems from the fibrous layer. This "retting" is sometimes done in water. When the fibre separates easily, the stalks are set up to dry. The old-fashioned hand-breaks are used to "decorticate" the fibre, and clean it of the fragments of bark and wood

left after the breaking is done. The freed fibre is tied in hanks, and these are baled for market. After being hackled it goes to the twine factory. Often the hemp-grower clears $30 to $60 an acre, after cost of growing it is deducted. And the land is left in better condition than before the hemp was planted.

The British navy consumes a quantity of hemp fibre in the manufacture of the bags in which coal is carried. Sail cloth, coarse sheetings and canvas, carpet warp and rugs, fish lines and nets, and all kinds of twine and ropes are made of hemp.

Hemp seed is not ripe when the canes are right for fibre, so special plots are grown for seed, which is valuable as poultry food. Oil for paint is extracted from the seed. The plants are best grown in hills so that they have room to branch and produce the greatest amount of seed. The seed crop often nets the farmer almost as much as if he grew hemp fibre.

In the Far East the resinous substance in flowers and leaves of hemp is a commercial product in great demand. In various forms, to drink, to chew, and to smoke, the intoxicating drug is universally used. The *bhang* is the dried leaves and fruits. It may be mixed with tobacco, for smoking, or with honey and spices, for a kind of

candy, or steeped like tea. *Hasheesh* is the name it is known by in Turkey and Syria. Hasheesh cakes, often huge in size, are sold in the bazaars. The effect of hasheesh is pleasantly stimulating at first; then follows loss of sensation, dulling of pain, and sleep with pleasant dreams. The result of constant use of the drug may be insanity.

### MANILA HEMP

Manila hemp is a Philippine export, grown on hillsides of Luzon and other provinces that have a very humid, hot atmosphere. The plant, near relative of the banana, grows like the maize, or Indian corn. The fibre is in the overlapping leaf-sheaths, that support a stem twenty feet high. When about five years old the plant throws out its flower shoot. When this appears, the whole stalk is cut down; the fibrous leaf-sheaths split into strips then the strips drawn under the blunt edge of a heavy knife, held against a board. The process scrapes the fibre free from pulp. In some places the work is now done by machinery.

This white or pale red fibre is stiff and coarse, but long, light, strong, and durable. It is the best material for binder twine and for ships' cables and other cordage. When ropes wear out, the refuse is made into Manila paper.

### SISAL HEMP

The plants that produce the fibre known to commerce as "sisal" are agaves, near relatives of the century plant, or aloe. The leaves are marginned with prickles, and grow out of the centre of the short stalk. After the plant is three years old the outer leaves are cut off and their fibres separated by a machine called a "raspador." For years a plant will go on yielding ten to fifteen leaves each season. The throwing up of the flower stem ends the leaf harvest, for the plant dies when it completes its work.

The "henequen," the sisal of Yucatan, the West Indies, Mexico, and Hawaii, is the most important variety grown. It has been established in India and in East Africa, where fibre of the highest quality has been produced. For cordage, sisal is second only to Manila hemp.

### RAMIE

Another member of the stinging-nettle family furnishes a silky, fine fibre from its inner bark. It is a tall, reedy stem, whose bark is stripped into "ribbons" which are scraped free of woody tissue, and later of gum and coloring matter. Ramie underwear has been introduced here. But

dress goods of this fibre are used chiefly in the Orient.

### JUTE

A relative of our bass-wood, native of Bengal, and grown successfully in China and Japan, where labor is very cheap, yields the jute fibre out of which gunnysacks are made. The plant grows to fifteen feet high, a slender, unbranched reed that is cut at flowering time, retted, washed, and whipped, the fibre baled and shipped to twine factories. Jute rugs and carpets do not last like hemp.

China jute is made from a plant that has come into our gardens as a weed we call Indian mallow and velvet-leaf.

### COIR

The cocoa palm grows on the shores of tropical countries, clustering its huge, three-angled nuts under an umbrella of leaves. The nut is egg-shaped, and the three-sided, smooth-rinded fruit is the husk. The green husks contain coarse, stiff, but elastic fibres that are made into door mats and coco matting in this country. In Asia and Europe, coir fibre is used for cables. The bulk of the coir of commerce comes from Ceylon, and from the southern shores of India and China.

The fibre becomes brittle if the nuts are allowed to ripen. It is used for leaf mold in greenhouses and conservatories.

### RAFFIA

The long, thin strips of strong, tying material that hang in greenhouses and packing sheds of nurseries are obtained by skinning the leaves of a palm tree that grows abundantly in the wilds of Madagascar and Brazil. The "Arts and Crafts" people discovered its usefulness in basketry, weaving, and other fancy work. Milliners made it into hats. The increased demand has doubled the price. It can be bought in a variety of colors. The uses are not yet extensive enough greatly to increase the present demand.

### BROOM CORN

Three varieties of sorghum are important: two as food plants, and the third furnishes the housewife with brooms. Kafir corn feeds stock and poultry in this country: it feeds both man and beast in Africa, India, and China. Sorghum molasses replaces sugar to a considerable extent. In our country to-day, it is a feeble competitor of sugar-cane and beets.

All of these species of sorghum belong to one genus, Andropogon, a member of the great Grass Family upon which the world depends for food. The blossom is a branching panicle at the top of a jointed stalk that grows like maize. There is no ear — the seeds follow the blossoms on the top.

Broom corn seed is planted later than corn in fields within the Corn Belt and farther south. Its culture is like that given to corn, and as the bloom passes the grower watches the clouds anxiously. Dry, clear weather is needed for the harvest. The crop is the "brush," or top, made up of fine, wiry, and very long branches that bear the small seeds. In the fields of standard varieties the harvest involves the "tabling" of the stalks, before the cutting of the heads. The stalks are partly severed three feet from the ground, and the tops bent diagonally over so that the brush lies across the broken stalks of the neighboring row. The bent stalks form a table on which the heads lie to dry. Each brush has two or three inches of stalk left for a handle, and is in prime condition if cut right after the bloom fades. If the seeds ripen, the straws become brittle and stiff.

Dwarf varieties are grown for whisk brooms. The stalks are pulled after blooming, and the

brushes dried and cut off. Oklahoma and Kansas are large producers of dwarf broom corn.

The special thresher or seed stripper, a kind of comb, removes the seeds from the straw, after which the brushes are finished by being quickly dried in airy, shady sheds, to preserve the green color as much as possible. The brushes are then compressed into 200 to 300 pound bales for shipment to the broom factories, or to the wholesale market.

# Plants That Serve Many or Special Purposes

# CHAPTER XI

## Bamboos

The giant grasses, that are more familiar to us in fish poles than in any other of the uses they serve, grow from sea level to an altitude of 15,000 feet. If we think of the clump of bamboo that makes an attractive feature in a neighbor's garden, it is a surprise to learn that some tropical species reach a height of over one hundred feet, and a diameter of a foot at base. Even these jointed canes that almost touch the sky are slim and graceful. In all, there are over two hundred different species of bamboo, growing chiefly in tropical countries, all around the globe. The Temperate Zone has a few species that are small and unimportant in comparison.

In Chinese restaurants a savory stew contains the tender shoots of bamboo. These blanched tips of oriental species are also served like asparagus, or boiled with rice, or pickled, or candied. The seeds of some species are like wheat, and these are mixed with honey, or

parched for food. Nut-like seeds of another kind are roasted.

We must go into a tropical country, where primitive people live, to see how many everyday uses the bamboos can be put to. The great naturalist, Alfred Russel Wallace, was amazed at what he saw in Borneo, of the admirable qualities and clever uses of the abundant reeds. "Their strength, lightness, smoothness, straightness, roundness, and hollowness, the facility and regularity with which they can be split, their many different sizes, the varying length of their joints, the ease with which they can be cut and with which holes can be made through them, their hardness outside, their freedom from any pronounced taste or smell, their great abundance, and the rapidity of their growth and increase are all qualities which render them useful for a hundred different purposes, to serve which other materials would require much more labor and preparation. The bamboo is one of the most wonderful and most beautiful productions of the tropics, and one of Nature's most valuable gifts to uncivilized man."

Then follows a long account of the Dyak houses, built and furnished with useful articles, even to cooking vessels, all of bamboo. The solid wall

that separates the pithy joint sections enables the brown man to make, with his knife in a very short time, a complete set of dishes that stand straight and hold water. A single reed makes cups and bowls, the sizes ranging from the thick base to the narrow tip.

Certain dwarf bamboos cultivated in China furnish material used in the manufacture of paper of all grades. Quite as many uses are found for small species as for the giant reeds used as posts and joist for houses and masts for vessels. The thin, hard rind makes knives with which arrows, pens, and such small things are cut and finished.

## PALMS

The rank of "Princes of the Vegetable Kingdom," given by grateful natives of tropical countries, is certainly deserved, for the uses to which palm trees are put are without number. "They are among Nature's most generous gifts to uncivilized men" — to quote the words of Wallace who spoke of the bamboo in the East Indies.

To begin with, there are in tropical and subtropical countries over 1,200 different kinds of palms. They are mostly trees of slender, unbranched stems, crowned or feathered with a

graceful head of foliage. All are of the same structure as reeds and grasses, in that they have round stalks composed of a pithy, central part enclosed in a hard rind, and growth is not indicated by rings of wood added year by year. The flowers are in spikes or clusters, usually coming out of the crown of the tree, and each flower is on the plan of three. Staminate and pistillate flowers are separate, though the clusters may be on the same or different trees.

Leaves differ in form of blade, but between the palmate and pinnate types, and all have stems, usually with clasping or sheathing bases. Our familiar palm-leaf fan illustrates the palmate form; the funeral palm, the pinnate or feather form. The most exuberant species bears leaves ten to thirty feet in length. The highest palm trees reach two hundred feet.

An old saying, of tropical origin, perhaps, says there is a use for the palm for every day in the year. The Hindoo goes further; for of one noble species of India he claims eight hundred distinct uses! What claim can be exaggerated for trees that furnish all the parts for a house and the furniture in it: thatch to keep out sun and rain, fibre for clothing, for paper, for ropes, brooms, and rugs; meal for bread, sugar, wine, and a cabbage-

Who can count the uses of the oriental bamboo?

California-grown dates that bring a dollar a pound because they are of the choicest dessert variety

like vegetable, the heart of the palmetto! Delicious food and drink come from the coco palm; wax from two species; resin for unnumbered uses from the palm called the "dragon's blood."

The savage tips his spears and his poisoned arrows with the spines of certain kinds of palm leaves. He makes knives of keen edge of the thin, hard edges of leaf stems. Tanning materials from palms are used in the making of fine leathers. Dyes are derived from other kinds. Valuable oils are among the best products of palm trees.

### THE COCO-NUT PALM

The coco-nut palm grows best on the shelly, barren soil of tropical shores. It loves the sea air, and as it grows, leans toward the water! A crown of leaves shelters the clustered nuts that turn from green to brown as they ripen.

It is the delight of native boys and men to run up the trees and throw down nuts, to the wonder of strangers, who pay the acrobats well for their feats, and who enjoy the fresh food and drink thus supplied. Inside the shiny, brown, three-cornered husk is the hard-shelled nut, lined with a thick layer of white meat, rich in flavor and in food value. The husk yields the useful fibre known in commerce as " coir."

The wide distribution of the coco palm is due to the fact that the nuts float, and are not injured by sea water, as they drift to other shores. They grow in the tropics of all continents, and are the chief food of the inhabitants of many tropical islands.

*Cocos* means *monkey*, in the Portuguese language. So it must have been when he was looking at the funny little monkey face on the end of a nut, the end with the three flat penny spots on it, that the botanist adopted the name that was applied in fun to the familiar nut by a Portuguese sailor.

The meaning of the three spots is not clear at first. One is always largest; this is the one that breaks to let the little plant escape on germination. The nut was intended to be in three compartments, with a plantlet, or embryo, in each. But long ago the partitions between the chambers got into the way of breaking down, and a single seed was developed, in the place of three. The two prints are all that are left to show that the plant has decided to have fewer and therefore stronger seeds.

We know the coco-nuts as they come to our markets, freed of their bulky husks, and carried as ballast in the holds of vessels from Jamaica and Trinidad. There is a tremendous demand for

them in the United States. We know the shredded and dried meat of the nuts, that lend such a fine flavor to desserts and candies we make. We do not know *copra*, though.

The dry meats are shipped under this name from the South Sea Islands and other far regions, to be sold at the factories where presses extract the valuable coco-nut oil of commerce. Plantations of the coco palms have been planted in the Old World as oil producers. In the New World, Brazil, and the West Indies, they are set out as fruit plantations.

### THE DATE PALM

The Arab may well claim that the best palm in all the world is his beautiful, feathery-leaved, desert-loving date palm, the palm of the Bible, and of ancient history in many languages. The hot sun only sweetens and dries the great clusters of dates, that feed the family, the camels, the horses, and the dogs. Wherever the Arab emigrant has gone, the date palm has followed, and become the dooryard tree, as it is at home. The meanest surroundings, the poorest soil, do not discourage the wonderful plant. Where there is sufficient water it grows, and makes a grateful

shade, and abundant food for the traveller. The desert of Sahara would not have been threaded by highways of oriental commerce in the past centuries except that date palms grew at the scattered oases, and furnished cheer for the weary caravans.

We can understand the jealous feeling that led the crafty Arabs of Asia Minor and Tunis to cheat the clever and energetic American horticulturists with seeds of inferior seedling varieties when the effort was first made to establish date culture in the hot regions of this country. The date palm does not come true from seed, and of seedling trees, but one in a great host can be expected to be a fruit of any merit. So progress has been slow, and discouragements many in the few spots adapted to successful date culture in America. At last suckers of good varieties have been obtained from dependable sources in the best date-growing regions of North Africa and Arabia, and we are at last getting home-grown dates from trees in the torrid Imperial Valley of southern California, from Yuma, Arizona, and other points, where the work of the Government Plant Introduction Bureau was first successful.

One thing the Arabs discovered long ago: the staminate, or male trees, are barren, and the

pistillate, or female trees, require to be fertilized, or they, too, are barren, though they blossom luxuriantly. It is a simple thing to cut a cluster of the pollen-loaded staminate flowers, and shake them over the pistillate clusters in the other trees. One pollen-bearing tree among twenty-five fertile ones will supply all the pollen needed. And the sex of a tree can be relied upon at the setting out of a new orchard. Cuttings, or suckers, reproduce their parent trees. Suckers from bearing trees will bear when half a dozen years old, or even younger. Many a tree stands alone in a garden, blossoms freely, then ripens no fruit; it lacks the fertilization. Without pollen no fruit can be produced.

The beginning of work looking toward the development of date-growing in this country was made in 1891. Already it is demonstrated a success. Time will bring the increase. We are even now growing dates that excite the envy of the old Arabian growers, for we have Science, the great Magician, helping us.

### THE RATTAN PALM

The Royal palms are noble specimens of their race. But one of these is not more interesting

than the rattan palm, that has not the necessary stiffness to grow erect. I quote the interesting description given by Mr. Wallace, who saw the plant in the Island of Celebes:

"The chief feature of this forest was the abundance of the rattan palms, hanging from the trees, and turning and twisting about on the ground often in inextricable confusion. One wonders at first how they get into such queer shapes; but it is evidently caused by the decay and fall of the trees up which they have first climbed, after which they grow along the ground till they meet with another trunk up which to ascend. A tangled mass of twisted, living rattan is therefore a sign that at some former period a large tree has fallen there, though there may be not the slightest vestige of it left.

"The rattan seems to have unlimited powers of growth, and a single plant may mount up several trees in succession, and thus reach the enormous length they are said sometimes to attain. They much improve the appearance of a forest as seen from the coast; for they vary the otherwise monotonous tree-tops with feathery crowns of leaves, rising clear above them, and each terminating in an erect leafy spike rising like a lightning-conductor."

The usefulness of the long, tough, supple stems

of the rattan palms is illustrated in homes the world over. Split rattan canes are the splints woven into seats and backs of chairs and couches. All kinds of beautiful furniture are made up with rattan weaving. It is a combination of strength and lightness, lace-like delicacy of pattern and color, that makes for comfort, especially in warm climates, where solid wood or metal furniture require stuffy cushions. Cane seats are cool and elastic.

The round rattan canes are used for many purposes; whip stocks, walking sticks, and hoops. Split into splints they are made into baskets, fish nets, weirs, and brooms.

### THE IVORY PALM

A low-growing palm of South America, fruits in a "head" of hard, heavy clustered capsules, containing four to ten hard, ivory-like seeds, each the size of a hen's egg. The texture of the seed is much like the ivory of the elephant's tusk, and is used in making buttons, and carved into ornaments of various kinds.

### THE SUGAR PALMS

A traveller in the East Indies describes the making of sugar from the true sugar palm and the

coco palm. "Each day the tapped trees of the latter species yield two quarts of sap that boils down to three or four ounces of sugar. That has a nutty fragrance and flavor, as unique as maple sugar. We were not long in learning to melt coco-palm sugar and pour it on grated ripe coconut, thus achieving a sweet supreme. The sugar of the true sugar palm of the market-places looks and tastes like other brown sugar."

## HOPS

The vine from which the housewife, a generation ago, picked the hops and dried them for use in making a yeast, is still grown in many a backyard, but the compressed yeast and the dry cakes have taken place of the good old-fashioned jug yeast on which the daily bread of the family depended. The hop vine is ornamental now, trailing its long fingers over the lattice that screens from view the neighbors' barns and any unsightly objects in the landscape. One good feature of the hop vine is the twenty feet or more of growth it makes in a single season. While slower vines are coming on it covers its trellis and reaches for more, climbing onto the roof or up telegraph poles, with apparent joy in its freedom.

Hop leaves are cleft like those of the grape and the hard maples. The inconspicuous flowers are followed by clusters of pale green catkins or cones, called "hops," that contrast beautifully with the dark foliage. Only the fertile (female) plants bear fruit in hops, the flower cluster of the sterile (male) plants merely pollenating the fertile ones, then fading, leaving the vine barren.

Hops are a valuable crop to raise, since the "burs" are used in the brewing of malt liquors. Two pounds of dry hops are needed for each barrel of beer. They give a pleasant bitter flavor to all malt beverages, and keep them from turning sour.

Young hop plantations are set with cuttings from the root crowns of old plants. Various systems of trellises are used to carry the vines up where they get the sun to the best advantage, and can be best let down for the picking of the crop. The climbing goes on without help in fine weather, the tendrils helped by the hooked hairs that roughen the leaves. But gray weather discourages the climbing, the shoots must be tied up or they fall. They refuse to climb any slope of less than 45 per cent., unless helped by being tied at intervals.

Four sterile plants to the acre are sufficient for fertilization of the fruiting vines. When the burs

feel papery and September is at hand, women and children from the cities go out to the hop harvest in England and the United States. New York has a large hop-growing section near Syracuse. The average picker gets forty to sixty bushels picked in a day. The boxes are carried to the dry house, where the hops are spread on a cloth that lies on a slatted floor above a room heated by a furnace. Sulphur, burned at first, bleaches color out of the hops, which come out a pale straw color twelve hours after they enter the dry, hot atmosphere. They are cooled and sweated, then pressed into solid cakes by hand presses. These bricks of hops, in cloth cases, weigh nearly 200 pounds, and are five feet long and twenty inches square at the ends. In this condition they keep indefinitely.

The cultivated hop is merely the wild species, native to Europe and America, member of the Nettle Family, brought into domestication. Nowhere does it grow in greater luxuriance than along river banks, where it finds rich, moist soil, and plenty of support in climbing.

The price of hops is peculiarly liable to change. Not many years ago it flopped from 12 cents to $1.20 the pound, without any noticeable reason for the astonishing difference. Ordinarily the

price runs between 12 and 40 cents. The crop pays well, unless it is an off year, when weather and insect enemies are against success.

### RAPE

A certain amount of rape-seed must go into the bird-seed ration of the canary, or your singer will not be well and happy. This every person who keeps a bird knows. Rape-seed produces an oil that is valuable for a number of different uses, and is as common in European countries as kerosene is in the United States.

The rape plant is a thin-rooted relative of the turnip, with a decided turnip odor, when a leaf is bruised. Above the stringy root rises a large head of succulent blue-green foliage, the leaves much divided and curled, like leaves of some of the kales. The tops grow two and three feet high on good, mellow soil; even four feet in soil especially rich and well-tilled.

The farmer sows the seed broadcast on a field from which he has harvested an early crop, like oats. Two months later he turns his pigs or sheep in, and they graze the tops off. It is best to let the stock have grass pasture, too, for rape alone makes flabby flesh, and animals are likely to

eat more than is good for them. Feeders of stock find the better plan is to cut the rape and feed it with grain and dry fodder in stable and feed lot.

Other methods are to sow oats, and a fortnight later sow rape, and harrow it in. The oats have the start of the other crop; they are harvested while the tops of the rape are short. Four weeks later the field is just right to turn sheep into. As fast as the tops are gnawed off new leaves are formed. This pasture keeps on coming when others are dry.

Rape makes a good nurse plant for clover, which is feeble in starting, and needs shade. This combination forms a good cover crop in young orchards. Feeding off the rape does no great harm once the clover becomes established.

In this country the value of rape is not yet realized by farmers and stock raisers. One visit to a good English farm would convert them.

For oil, the rape-seed is put through fanning mills, and cleaned of all foreign bodies. Then it is run through rollers, which reduce it to a paste. Next, this paste is heated, and put under a pressure of 2,840 pounds to the square inch. The oil oozes from under the press, and is collected in troughs that lead to reservoirs. The cake that remains is ground and sold for stock food, as rape-

seed meal. It is also used as a fertilizer. It still contains considerable oil, and is rich in nitrogen, the most expensive element that plants require.

The oil is refined and filtered for table use and for cooking. Without filtering, it is the staple illuminating oil of Europe, and is quite as commonly used for lubrication.

I do not know of a better instance of a weed that has been brought into the service of man than rape, which makes wealth in so many forms, both as raw materials and easily manufactured products.

## FULLER'S TEASEL

In this day, machinery takes the raw wool and cards, spins, weaves, and dyes it, with scarcely a hand touching the warp or woof until the finished cloth is rolled onto a bolt for the merchant to unroll on his counter. One process in the making of cloth depends upon the seed heads of a weedy plant. No inventor has been able to imitate in steel the fuller's teasel. It comes down into the modern woolen mills from the days when it helped the hand worker to bring up the "nap" on cloth. All the primitive machinery has passed into museums — all but the hooks on the teasels. They were as flexible, as strong, as efficient in the begin-

ning of cloth manufacture as now. The only improvement they have seen is in the device that holds them in position as they do their inimitable work in finishing fine cloth.

For blankets and other woolens with the longest nap, the "king" teasel heads are required. Shorter nap, such as English cloths have, is made by the "queens." Broadcloth has a fine, short nap that is produced by the smallest teasel heads, called "buttons."

The common teasel of waysides and neglected fields is not the same as the cultivated "fuller's teasel." But it is so close to it that few people would distinguish the commercial from the worthless species, unless they had experience in teasel-buying. Look at a full-grown teasel, and the "king" is easily seen standing at the top of the straight, main stem. The "queens" are on the ends of the main branches. The "buttons" tip the secondary branches. One king, several queens, and a multitude of buttons — that is the way they run in size and numbers.

Teasel plants have some very interesting peculiarities. The paired leaves that clasp the stem form a deep cup at each joint where branches start, and this cup catches and holds a pint or so of water. If this water is lost, the heads above will not be

perfectly formed. At least, this is what growers of fuller's teasels declare. They say, too, that the flowers of all other heads depend on the king for pollen, and if the king is dethroned at blooming time the other heads will fail to mature seeds, though they come to larger size.

If the teasel is grown in your neighborhood, find out if these things are true. The cultivated species is raised on a commercial scale in Onondaga County, New York, where is it a great success. Small plantations in Oregon do well, but buyers prefer the New York teasels.

European countries buy buttons from America for broadcloths, and we import kings for the making of our blankets. So there is exchange between teasel-growing countries.

Teasel seed is planted in drills, the plants thinned to ten inches apart in the rows and cultivated like corn. Each forms a large rosette of leaves the first year, and throws up the blossom stalk the second spring. The blossoms, crowded on the oval head, begin to bloom in a purple belt around the middle. As these flowers fade, the bloom proceeds toward the top and bottom. Two bands of purple are moving in opposite directions, until the base and tip have shed their withered petals. This curious habit may be seen

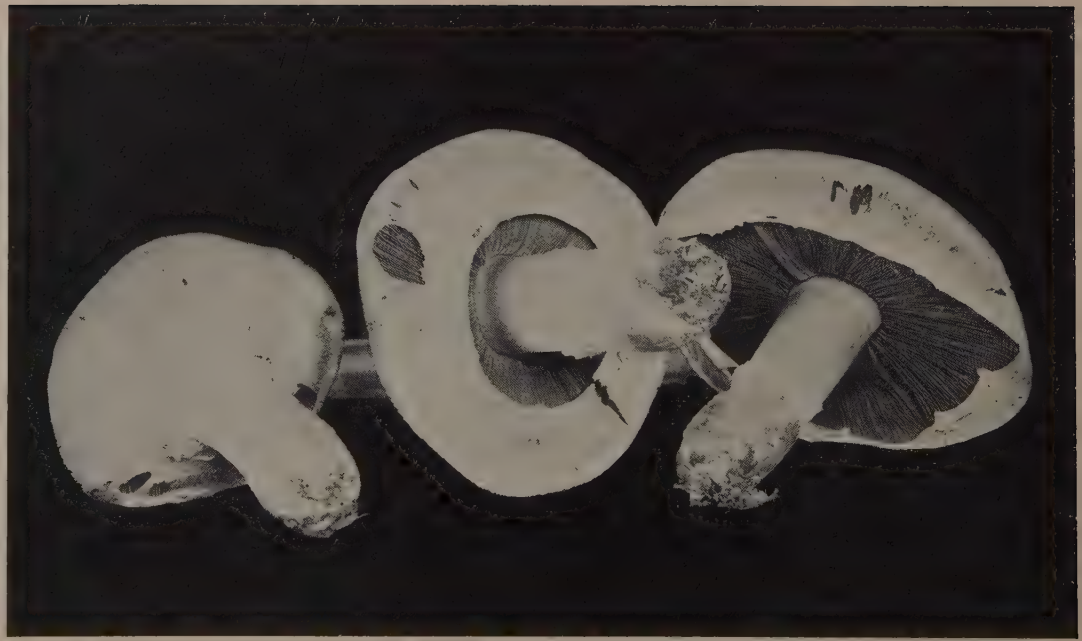
in any roadside teasel. The wiry, backward-turning bracts under the individual blossoms are the hooks that "full" the cloth by picking up the ends of fibres, and thus forming the desired "nap."

The teasel buyer pays about a dollar a thousand (ten pounds) for dry heads. The grower cuts the heads with a few inches of stem, and spreads them in lofts of barns or sheds to dry. A fair yield in New York is 100,000 heads per acre. In Europe intensive farming on land much higher in value produces a crop three or four times as large. Considering that the field is in use two years, and must be very carefully tilled, the grower's income is not large, though it is good. His job is to sort the heads, shorten the stems, and pack his stock for shipment to the manufacturer. The heads are surprisingly long-lived in use, the hooks having to be cleaned of fuzz often before they become worn out.

## RUBBER PLANTS

When white men first came to South America and explored the Amazon River and adjoining territory, they saw native Indians at home, and had many surprises regarding the life they lead. They noticed a game played with a large ball of

A young rubber tree in the plantation



The pink-gilled meadow mushroom is the one grown commercially

dark substance, that bounded high when it struck the ground. It was natural for the strangers to examine the ball, and try to find out what it was made of. The Indians called it by a name that sounded like "ca-chook." The substance was not rigid, but flexible; could be kneaded out of shape, but returned to its round form when pressure was released. The Indians said it was the dried juice of a tree, but for some time the curious explorers had no idea what trees produced it. Some one of them, handling a bit of the strange substance, — possibly writing a letter describing it — discovered that it takes out pencil marks. He was probably delighted to discover this useful property of the bouncing ball. He called it "rubber," and this name has always stuck, and no other substance has been found so good for pencil erasers, to this day.

We can imagine the interest roused in Europe by the specimens of rubber that reached there from America. Explorers in the Amazon territory, and other tropical regions, found that the natives had rubber in their possession. Not long before our Revolution, a party of Frenchmen saw natives tapping trees and gathering the flow of juice. This was the first discovery by white men of trees that yield rubber. They learned how the juice

was converted into rubber, in the districts now forming the countries of Brazil and Guiana.

What real good is there in a substance that can be pressed out of shape, but returns when pressure is removed? That is capable of being stretched and of flying back to its original length? At first the new product seemed more interesting than useful. The growing European demand for the rubber stimulated the Indians to go on gathering "wild rubber."

The vast number of uses to which rubber is put to-day make it seem a necessity of life. We smile at the grave scientist of the eighteenth century who gave out as his judgment that the new substance would attain some popularity as an eraser of pencil marks, but, as for him, bread crumbs were very satisfactory for that purpose. Not long afterward, Samuel Piat discovered a process of waterproofing cloth by treating it with India rubber dissolved in turpentine. Our raincoats take their names from a Mr. MacIntosh who improved upon the original patent. Then came the invention of Goodyear, who, by the addition of sulphur, hardened rubber, and adapted it to many uses.

In one form and another, we can count a dozen rubber articles in daily use by us, and not one

could be made to serve the purpose so well if made by any other material. No known substance has the elasticity of rubber, and springs back to its original shape when tension is released. No substitute for the indispensible rubber band is likely to appear.

The modern rubber industry is built, however, upon the process of vulcanization, which hardens and darkens the crude caoutchouc, reducing its elasticity, in various degrees, according to the proportion of sulphur added, and the thoroughness of their union. Vulcanite is the name given to the product. It is not so sticky as pure rubber, it resists ordinary solvents, and changes of temperature. It is adulterated with pigments and other mineral substances. The colored "rubber goods" in the druggist's window illustrate vulcanite in modern everyday conveniences of the household. Thirty to 70 to per cent. of the weight of rubber tires of vehicles is mineral substance. The rubber plate of false teeth is largely coloring matter.

Ebonite is the hardest form of vulcanite, black, brittle, shiny. We buy it in combs, photographic trays, and in the insulation of electric apparatus.

The invention of rubber tires for vehicles has given the rubber market a tremendous lift within recent years. Automobiles consume the greater

part of the supply, and need more than the market can furnish. The price keeps step with the demand. The cultivation of rubber in plantations has been started, in order that rubber production may be put on a scientific basis, and the yield increased.

Legal restrictions now prevent the abusive treatment of the forests of rubber trees. They may not be cut down, as formerly permitted, and tapping must be done at stated intervals, to let the trees recuperate from the exhaustion they suffer. At present the simple natives, who do the work of gathering crude rubber, are under the control of syndicates which have concessions from the countries in which the trees grow. The work is hard and the pay small, at best; but cruel treatment, even atrocities, have been committed by overseers, to extort more wealth for the company. The African, Peruvian, and Central American forests have been the scenes of such abuses. Investigations that have given publicity to the facts will doubtless soon lead to their correction.

Between the native, who gets scant pay for crude rubber, and the consumer, who pays an extravagant price for one tire for his automobile, and but half of that rubber, there is a tremendous profit for the maker and the seller. No wonder

people get excited on the subject of rubber plantations, and invest recklessly in shares in such schemes, for the suave "promoter" can easily prove that there is money made in the rubber business.

From Brazil, rubber culture has spread and become established in all important countries in the Tropics. Investigations have determined just the trees and other plants that produce rubber in paying quantities. The best methods of harvesting the crop have been tested, and are being established to replace worn-out, wasteful methods.

Crude rubber is the coagulated milky juice of several trees, chiefly of the Euphorbia tribe, or family. It is produced in a network of passages that lie in the bark, near the cambium, or living layer, that separates wood and bark. To get the fluid, the trees are tapped, and the flow led into cups that are emptied at regular times, and the sap treated, without delay, to hasten the coagulation of the caoutchouc, and to evaporate the watery part.

The harvesting of rubber has in late years interested even the uncivilized tribes, now the slaves of the Rubber Companies; for they realized that it was bad business to abuse or kill the tree that

produces rubber. To get the greatest quantity of rubber with the least injury to the tree is the modern problem.

The oldest method of tapping was to cut troughs down the four sides of the tree, and catch in some crude way the flow of sap. Then the plan was to cut four V's as high as the reach of a man standing by the tree. A cup was fastened at the point of each. Other V's cut at intervals drained the area below. This overtaxed the trees.

The method in general use now in harvesting Para rubber is the herringbone system. A vertical trough is cut with alternating side troughs, slanting at 45 degrees and about a foot apart. The cup set at the base of the main trough catches the flow. Each day, when he comes to empty the cup, the collector cuts a thin slice of bark from the lower edge of each lateral trough. This opens the clogged passages, and renews the flow. The daily cutting is repeated until the side troughs are nearly two inches wide, or until decrease in the flow indicates that the tree is drained. Six months of rest allows the tree to heal its wounds, and reëstablish the network in which the milky juice is found.

The spiral system, a winding trough around the trunk, is a new method, that gets the greatest

flow of sap. Whether it is best for the tree remains to be seen. A plan to prick the bark, puncturing the net-veins but not going deep enough to injure the cambium, is a perfect method; but the collecting of the flow is the difficulty. Such treatment would not hurt the trees, if done on alternate days. It might go on for years.

Tapping on rainy days and early in the morning induce the greatest flow, for the heat of the sun causes the juice to coagulate and stop the passages. Young trees and trees too heavily drained yield rubber of poor quality. So do the upper parts of trunks and the limbs. These facts are known to the greedy rubber gatherer, and it saves the tree from many abuses.

*Para rubber* comes from a tree called *Hevea Braziliensis*, that grows wild in different parts of the silvas of the Amazon, and in Peru, Bolivia, and Guiana, a total area of millions of square miles. Para is the port from which most of it is shipped. Brazil furnishes the world about half of its rubber supply — exports amount to fifty-four million pounds a year. Not all of this is Para quality.

Because Hevea trees produce the highest quality of rubber, they have been planted where new plantations are desired. They are established in the West Indies and Trinidad, and in

Ceylon and the Malay Peninsula, where English companies have started great plantations. Between 1900 and 1910, Para rubber rose in price from three shillings to twelve shillings per pound! It costs about one shilling per pound to collect from the wild or to produce in plantations. The price fluctuates in the hands of speculators, quite independent of supply and demand.

*Central American*, or *Panama rubber* is from a tree called *Castilloa elastica*, which grows ten degrees north of the equator. The rubber has not the strength of Para, and brings a lower price. It is the tree of Mexican and Honduras plantations.

A tree that reaches sixty feet in height, and yields rubber almost equal to Para, is *Sapium Jeumani*, that grows in Colombia and Guiana. In cultivation, it does surprisingly better than in the wild.

The "India rubber" plant of the northern greenhouses, *Ficus elasticus*, is the *Assam rubber tree* in its East Indian forest home. It may begin life as an air plant, fixing its roots in the crotch of another tree in which a seed has lodged. A shock of aërial roots strike downward, and reach the ground, after which the top depends upon food drawn from the earth, and the supporting host tree is no longer needed, for the rubber tree by

this time has a stiff trunk, and is able to stand alone.

Assam rubber is not inferior to Para, except that it is not so carefully gathered, and comes dirty to market. The mountain trees are the only ones that produce first quality rubber.

*The Silk rubber* is a tree sixty or seventy feet in height, as it reaches maturity in the forests of Africa. It crosses the central part of the continent, from east to west, the seeds wafted away on the long, silky filaments that give the tree its name. "Funtum" the natives call it, and the scientific name is *Funtumia elastica.* The trees are tapped by the herringbone method, the latex (milky juice), collected in hollowed-out logs, and covered with palm leaves. The water is absorbed by the porous wood, and the spongy rubber that remains is kneaded into balls and sent to market.

In the West African forests the natives are practically slaves to the agents of the company that holds the concession from the government that rules the district. King Leopold of Belgium has been held personally responsible for much of the abuse that has terrorized the blacks.

Several different species of woody climbers of the genus Landolphia, near relatives of the

Funtum tree, yield rubber when tapped. The latex is spread out, coagulates, and layer on layer, is prepared for market. The old method was to cut down the vines to drain their juices. As they grow on forest trees, they form a jungle in which it is difficult to collect the latex.

The rootstocks of certain Landolphias and other plants, and the tuberous roots of the Guayule plant of Mexico and the Ecanda plant of West Africa yield "root rubber," which is extracted by breaking them up in hot water, and later separating the waxy rubber from the residue.

It is not likely that these plants will be used when the growing of plantations and the harvesting of rubber from wild forests are put on a sound economic basis.

### GUTTA PERCHA

"Getah taban" is the name by which the native of the Malay Peninsula calls two closely related trees that he taps for their gray, milky juice. The shamefully wasteful, primitive method is to cut down the tree, strip off the bark in rings, groove the wood to make the juice flow, and boil the fragments of wood and bark to get all the latex possible. It is the residue, after the water

is all evaporated, that he sells, as "gutta." We call this solid substance "gutta percha."

The peculiar property that sets gutta percha apart from rubber is its softening in warm water, and becoming rigid again when cooled. It is inelastic. Otherwise it is like rubber.

Gutta percha is used chiefly to insulate wires in electrical apparatus. The laying of the Atlantic cable created a considerable demand for it. Dentists and artists prefer it to other substances for taking impressions. It is one of the materials used for the handles of surgical instruments, and similar articles.

The nearest natural substitute for genuine gutta percha is made from the juice of the bullet tree, a near relative of the true getah taban. It grows in Trinidad and South America, and its juice, while containing gutta, is about half resin, which is a great nuisance. The product is called Balata, or Surinam gutta percha.

"Pontianac," made from the juice of certain East Indian trees, is an inferior waterproofing material, cheap in price, for, with a small proportion of gutta-like substance, it contains a high percentage of resin and other elements.

The five species of true gutta percha trees belong to the genus Dichopsis, and grow only on

the Malay Peninsula, or near it. The Balata, or bullet tree, is *Mimusops bullata*, whose rich, sweet fruit is found regularly in the West Indian markets.

### MUSHROOMS

The decay of plants keeps the surface of the earth littered with débris of fallen leaves and branches, and underground stems and roots. Swarms of microscopic plants, called *bacteria*, are at work reducing the tough, woody substances to their original elements — making vegetable mold, upon which living plants can subsist. Earthworms are helping, by consuming this mold, to mix the surface mulch with the mineral, earthy soil below. They are the natural plows that reduce clay and plant mold to that rich, productive mixture the farmer wants — a live, porous loam.

Among the other plant organisms that feed upon the broken and decaying parts of dead plants is a group of flowerless plants called *fungi*. They multiply unseen, in the moist warmth of decaying roots, under the bark of fallen logs, everywhere that stored plant food is available. Decaying plant tissues present the richest possible pasturage to fungi.

Finally, when their bodies are fat with nourish-

ment, they suddenly turn their energies to fruiting. Out of the ground, or out of some pile of decaying wood, a grove of pallid mushrooms appears. They come up in a night, and set us to marvelling. We have not seen the plants themselves. Tear the bark off of the rotten log, and there, between wood and bark, lie the pale threads, like a mass of tangled yarn. Without the weeks of growth unseen, no mushrooms could have been formed.

The pink-gilled meadow mushroom, whose cultivation is the absorbing occupation of many gardeners, and whose search takes us all into the fields in the fall of the year, is the species best known as a food plant. The fleshy, cream-colored umbrella is hung with dull pink "gills," that turn brown in a short time after the "button" opens into the umbrella. Cut a fresh one from the stem, and lay it on a sheet of white paper. Next morning you will find on the paper a pattern of the gills made by a fine dust that has fallen from each in a tiny ridge. A breath will blur the distinct lines, for the dust is impalpable, almost. These "spores" are to the mushroom what seeds are to the higher plants.

The claim that mushrooms are as nutritious as beefsteak may be exaggerated. Much of them is water. The reason they are good food is that

they present us, in a new form, much of the rich material that was in the bodies of the plants whose decay it feeds on.

The tall "*shaggy manes*," with half-closed umbrellas, and roughened surfaces, belong to the ink-caps, a group of mushrooms whose spores are not scattered by wind, as the powdery ones are, but carried off in an inky fluid, into which the gills seem to melt, as they pass their prime. They are not edible after the gills begin to darken.

Some of the gayest mushrooms are not fit to eat; a few of the pale edible-looking ones are deadly poison! The "destroying angel," called the "death cup," also grows in the woods among the fine, wholesome kinds, and it is most important to let all mushrooms alone, unless you know, with certainty, the edible kinds at sight. People who do not know the good from the bad should not collect mushrooms, and rely on selecting the good ones later under the eye of a competent judge. The poisonous mushrooms contaminate those they touch. So there is real danger in taking any chances.

*Pore-bearing fungi* let their spores escape by minute holes in the under surface of the spongy umbrella, or bracket, of the fruiting body. The huge bracket fungi, of dying trees, and many of the

brilliant red and yellow mushrooms of the woods, belong to this group.

*Puff-balls* are fungi of globular or pear shape, that burst on ripening, and their spores escape like a cloud of snuff, to be scattered by the wind. In the cheesy stage these fungi are good to eat. None is poisonous, though none is as rich in flavor as the best mushrooms.

Many people grow mushrooms for home use and for market in cellars. The soil is made by mixing horse manure with garden loam, and planting it with mushroom "spawn" — bits of the dried *mycelium*, or thread-like body substance, out of which the umbrellas rise. Though they grow in the light in meadows, these mushrooms are happier as "children of the dark."

THE END

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